

THE INDEPENDENT GUIDE TO IBM PERSONAL COMPUTERS

PBR

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April 3, 1984

The IBM Compatible Universe

*Exploring
Beyond
Big Blue*

**TI's Terrific
Two-in-One
Printer**

**IBM Invades
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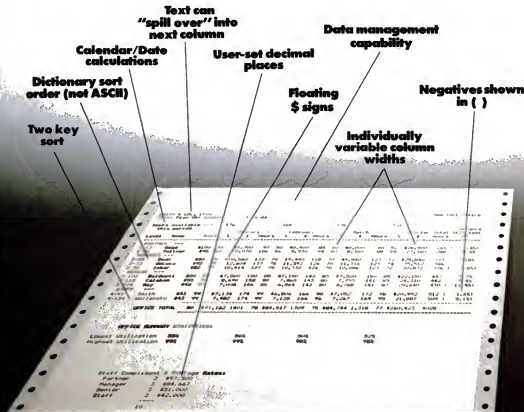
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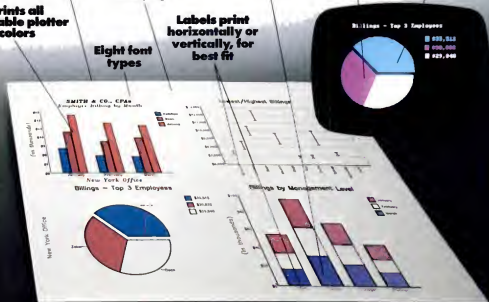
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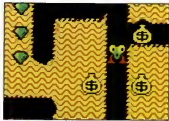
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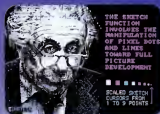
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CIRCLE 219 ON READER SERVICE CARD





What's Inside

Assembling the computers, the writers, the copy, and the photographs for this issue's cover package on new PC compatibles has been a wild and crazy experience.

Some readers of *PC* may be under the impression that life in a magazine office resembles something akin to that in a well-heeled law firm: Cool, debonair executive editors sit behind mahogany desks calmly making decisions and issuing orders while the other employees, feet up and chairs back, make occasional blue pencil marks on well-crafted manuscripts.

Well, an office like that may exist somewhere, but not here. While we were preparing this month's cover story on PC-compatible computers, the scene at our offices was something more on the order of a Marx Brothers' movie. So that you, our readers, might appreciate a few of the more minor difficulties that arose, here is a short diary of the cover story's birth.

December 16, 1983: Executive editor Mike Edlehart calls two of *PC*'s more recently acquired employees into his office: technical assistant Mike O'Conne and associate editor Barbara Krasnoff. He informs them that the magazine is going to present a rundown on all the PC-compatible computers that have recently hit the market. They are going to be in charge of organizing the testing—a small assignment that should prove interesting and present few difficulties. O'Conne and Krasnoff agree. This is their first mistake.

December 19: O'Conne begins going through the *COMDEX Program* and



Exhibits Guide, past issues of *PC*, and a variety of other materials, gathering the names of various computer companies that manufacture compatibles. He comes up with about 30 candidates. So far, so good.

December 20–30: O'Conne and Krasnoff begin making phone calls, under the naive impression that any computer company that touts its machine as "PC-compatible" would be happy to have its micro tested by such a reputable publication as *PC Magazine*. They are soon disabused of that notion.

It seems that as soon as many of the marketing and/or public relations managers hear the word *testing*, they go into a

minor state of shock. Some beg off because their computers are "still in the prototype stage" and not yet ready for testing. "In another month," runs the refrain, "We'll be 99 percent PC-compatible, but we're not ready for you yet."

Still others suddenly discover that their machines are not PC-compatible, have never been PC-compatible, and lay no claims to being so. Sure, they run MS-DOS, but that is an altogether different kettle of fish. "Those advertisements you saw? Oh, simply a misunderstanding—it's been cleared up," they explain.

Then there is the machine that isn't yet FCC approved, the computer that is so loyal that it will not run unless its engineer is standing within 3 feet of it, and the several major manufacturers that just can't find one available machine on the East Coast—not to mention the executives who simply refuse to answer their phones.

By the end of the first week, O'Conne and Krasnoff have done a Jekyll-and-Hyde transformation from two reasonably sane human beings to a pair of manic creatures who spend most of their time on the telephone alternately cajoling, threatening, and pleading with a variety of marketing managers. Edlehart assures them that they are doing a fine job. O'Conne, who is simultaneously helping organize the tests, assemble the computers that do

WHAT'S INSIDE

show up, and keep track of those that won't, nods vaguely and disappears. Krasnoff, who amid all the chaos has chosen this week to contract the flu, sneezes. Things are not looking good.

January 2-13, 1984: Krasnoff and O'Conne are still making phone calls. Somewhat to their astonishment, about 17 computer manufacturers have agreed, some even enthusiastically, to supply machines for testing. Edelhart begins to organize our contingent of technical writers, one of whom promptly has a nervous breakdown and is therefore temporarily unavailable.

New York City experiences one of its biggest snowstorms of the season. O'Conne drives to New Jersey to pick up a Sanyo computer, while Krasnoff tries to figure out how Eagle's Spirit XL machine ended up in Chicago (a mistake in paperwork—the machine is actually sitting in New York's LaGuardia Airport).

One manufacturer, Visual, is persuaded to send over one of the few prototypes available of its Commuter micro. Columbia's public relations account executive brings his own machine from Philadelphia when it was discovered that the micro that was sent had disappeared in transit. A couple of companies call and say that they've changed their minds; they're not sending anything after all.

Computers begin to drift into the PC conference room, transforming it into something resembling a cut-rate dealership. Leading Edge, which earlier had maintained that it couldn't possibly send its computer, changes its mind. Mad Computer, after receiving calls from Krasnoff, Edelhart, and O'Conne, decides to send down a prototype after all. The Visual prototype breaks down, and an engineer is dispatched. The missing Columbia computer shows up, and the account executive is dispatched to retrieve his machine.

January 16: A somewhat motley group of technical writers assembles in PC's offices, ready to go. It includes Robin Webster, a refugee from Great Britain

who wanders around looking slightly lost and inquiring, "Why isn't there any BASIC for the Tava?" Glenn Hart, a bear-like, genial gentleman, labors over the machines in his shirt sleeves amid a cloud of cigarette smoke, while Winn Rosch, a name not unfamiliar to readers of *PC*, arrives about 2 hours before his computers do.

These exemplars of technical savvy immediately turn on every computer in the place. Of course, they blow a fuse, leaving most of the editorial offices in darkness.

January 17: The fourth writer in the

The exemplars
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group, John McMullen, shows up with three of the portables that arrived early and his own Compaq ("Just in case I have time to do a little writing today," he explains). His wife Barbara, who will help in the testing, accompanies him. Surprisingly, the computers that the McMullens are supposed to review have actually shown up.

January 18: O'Conne begins packing up the computers to send to the studio where they'll be photographed. Art director Mitch Shostak has a wonderful idea: illustrate how portable the portables really are by shooting them in an interesting, exotic location—like Florida.

The computers are readied for Florida. O'Conne is readied for Florida. Computers are still coming in, and Krasnoff is still on the phone, this time yelling at manufactur-

ers that swore that their machines would be in the offices by January 1st and that haven't sent them.

January 20: O'Conne leaves for Florida with Shostak and the portables. He is not pitied by the other members of the *PC* editorial staff, who are fighting their way to the office through mounting snow and 10-degree temperatures. Krasnoff has given up on the manufacturers and is now harassing the writers, who are expected to write sterling copy in approximately 48 hours.

January 23: Bill Machrone, who has been overseeing the chaos with all the equanimity of the true editor, is drafted to review two of the machines that came in after the writers did. He loses some of that equanimity.

January 24: As this is being written, a race is on to meet the copy deadline for the cover story. Machrone attempts to review two computers in about an hour, while the McMullens are driving in from Westchester, New York, through an ice storm to get their contribution in on time.

And a new delegation has entered to increase the general sense of anarchy. *PC*'s stalwart copyediting staff, headed up by manager Anne Freed, has been working around the clock to get the manuscripts into shape by deadline day. Senior copy editor Jennifer de Jong pesters Krasnoff, who complains to Edelhart, who calls Machrone and demands that he get to work at once. This is how the chain of command occasionally operates at *PC Magazine*.

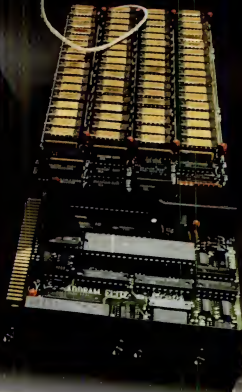
The entire situation has, in fact, taken on the general flavor of a melodramatic, old-time radio cliff-hanger. Will Machrone finish his article on time? Will the McMullens make it through the ice? And what is happening to O'Conne in Florida? Stay tuned. ■

Editor's Note: It wasn't easy getting these machines in the first place, and we'd be crazy to give them up. Look in upcoming issues for detailed hardware reviews of some of the more outstanding machines.

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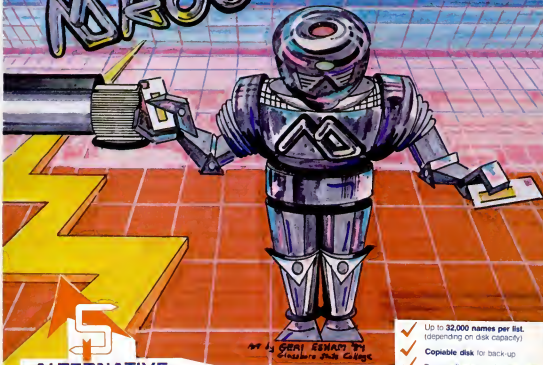
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IBM News

FROM THE EDITORS OF PC

APRIL 3, 1984

IBM Targets Compatibles In Two Copyright Suits

IBM bases legal actions on Apple-Franklin precedents. In settlements, Corona Data Systems and Handwell Corp. agree to halt sales of computers with disputed BIOS chips

BY KAREN COOK



A PC In Question: BIOS chip redesign won't affect compatibility, Corona says.

In what may be the first of a series of actions against makers of IBM compatibles, IBM has filed—and settled—copyright infringement suits against Corona Data Systems of Westlake Village, California, and Handwell Corporation, an import-export firm with offices in Los Altos, California.

IBM claimed compatible manufacturers had copied software that IBM built into the BIOS (Basic Input-Output System) chip of the PC. The BIOS chip has software programmed into ROM that controls the cen-

tral processing unit's interactions with the computer's monitor, keyboard, and disk drives.

Neither Handwell nor Corona admitted that they were guilty of piracy, but both firms agreed to stop marketing computers using the disputed software. The Corona and Handwell settlements were negotiated privately, then registered with two U.S. district courts in California.

The muscle behind IBM's action is a federal court decision handed down last August in the case of *Apple vs. Franklin Computers*. The judge ruled that

software programs buried in ROM chips are protected by copyright. As a result, says Corona vice president for marketing Larry Lotito, "IBM is making a point of enforcing their copyright in a legal fashion." Lotito doesn't think that Corona is being singled out: "I expect IBM to take other actions," he says.

Corona agreed "to replace the chip we have with one that is

clearly unquestioned by IBM," Lotito says. Compared to a costly legal battle with IBM's cadre of high-powered law firms, the cost of redesigning the contested software itself is slight, Lotito explains. At press time, Lotito expected no problems in meeting the February 18 deadline for altering the chip and insisted that the changes would not reduce the com-

(continued)

Visi On Debuts In Confusing Times

Software Arts strives to regain VisiCalc as VisiCorp brings product to market

BY CONNIE WINKLER

PHOENIX — VisiCorp — which is in the midst of launching its ambitious integrated windowing package, *Visi On*—finds itself in crazy times:

- It has dropped the price of the *Visi On Applications Manager* package, which is neces-

sary to run any of the applications packages, such as *Visi On Calc* from \$495 to \$95;

- It has withdrawn from exhibiting at the Softcon show in New Orleans;

- Software Arts, the de-

(continued)

IBM Suits (continued)

puter's compatibility with the PC.

Olivetti Connection

Although IBM watchers agree that Corona is unlikely to be the last compatible-maker to face a day in court, they also speculate that Corona's relationship with Olivetti may be the reason the company was the chosen target of IBM's legal brushback. Corona has been supplying the micros recently introduced under the Olivetti PC label, marketed by Docutel/Olivetti.

Even more intriguing to observers, about 45 percent of Docutel/Olivetti's stock is held by Olivetti of Italy, which in turn is one-quarter owned by a U.S. corporate institution that rivals IBM: AT&T.

Is IBM's suit against Corona a backhanded slap at AT&T? "Maybe there is some connection," admits George Christian, Docutel/Olivetti's product manager for the PC. "We've been wondering why Compaq wasn't chosen first, since they have probably copied the BIOS ROM more closely than anybody else," he adds.

IBM's suit against virtually unknown Handwell Corporation, reportedly an import-export firm distributing IBM-compatible micros from Taiwan, appears to be another of IBM's stabs against piracy in the Orient. Michael Wu, a vice president for Handwell, refuses to discuss any aspect of Handwell's business. "It is all settled," he says. "I do not feel comfortable saying anything at this time. To receive any coverage will hurt us."

IBM spokesperson Ed Nanas says only that "Handwell has agreed to no longer infringe on our copyrights." Did IBM tag Handwell while scouring the Orient for PC knockoffs? "Could be," Nanas replies. However IBM discovered Handwell, its researchers apparently did a thorough job: According to a clerk for the U.S. District Court in San Jose, where the Handwell papers were filed on January 20, IBM's legal brief against Handwell is 6 inches thick. ■

Visi On (continued)

Velopers of the original VisiCalc, is going to court to get back the rights to the latest version of VisiCalc and the VisiCalc trademark. Software Arts says VisiCorp has not used its best efforts to market VisiCalc, but is steering customers toward Visi On.

"We're going for the gold," said VisiCorp chairman Daniel H. Fylstra, about the price drop on the applications manager. Visi On is the first windowing software actually available in stores, he said proudly, noting that it has been 3 years in development. This is VisiCorp's "window of opportunity" to establish itself, he added. One software industry observer suggested Visi On is going to be slow to catch on, just as it took 16 months to begin getting software for the PC.

Lotus Development Corporation announced its *Symphony* product about 10 days later, but Fylstra said he didn't know of the coming Lotus product. There was, however, a "crazy Wall Street reaction" which hurt VisiCorp's stock, but that was

due to "misunderstandings" because Visi On was being compared to Lotus' 1-2-3, he added.

Second Thoughts

As far as Softcon is concerned, Fylstra said there were too many shows and that some take up more time and trouble than they're worth. He also mentioned that VisiCorp was going to spend approximately \$200,000 per trade show on the fall COMDEX and the National Computer Conference (NCC).

"We are not the only company who has pulled out of Softcon," Fylstra said, acknowledging that the San Jose-based VisiCorp had signed up originally.

Now Software Arts, which since 1979 has had a software distribution agreement with VisiCorp, has gone back to U.S. District Court in Massachusetts to terminate that agreement. (Software Arts received at least a 35.7 percent cut of VisiCalc sales.) Coincidentally, the Software Arts move came as all the lead characters from both firms attended the Rosen Research Personal Computer Conference

here, an annual gathering.

Software Arts also wants to take VisiCalc marketing into its own hands—pumping it into the same dealer/OEM/direct sales network that distributes its own product, *TK! Solver*.

"VisiCorp has not been using its best efforts to maximize VisiCalc sales," emphasized Julian Lange, president of Software Arts, "as the marketing agreements require."

Lange and the VisiCalc inventors—Daniel S. Bricklin and Robert M. Frankston—were apparently most incensed by a VisiCorp advertisement in the *Wall Street Journal* in early January which advised VisiCalc owners they could trade in their Advanced VisiCalc versions towards Visi On Calc.

Fylstra counters that this trade-in follows what VisiCorp has always offered its customers who want to upgrade to the next release or version of the Visi-Series products. The price of the product the user owns is applied toward the new product.

"This is our general policy," said Fylstra. "We take care of our users." ■

Now Pitching for IBM... Billy Martin?



After 2 years, Charlie Chaplin and IBM seem to belong together as much as Barnum and Bailey. But what if IBM had selected another person to represent its Personal Computer?

The names of some other celebrities that IBM considered were revealed at an Advertising Age Creative Workshop by

Charles Pankenier, manager of communications for IBM's Entry Systems division, according to the *Computer Publishing & Advertising Report*. We wonder if the PC would be as successful if its star had been hitched to one of these stars: Alan Alda, Beverly Sills, Kermit the Frog, or Billy Martin.

The last name on IBM's list puzzled us the most. How would IBM have used baseball's most controversial manager in its television commercials?

We imagined this scenario: a ballpark on a summer day. George Brett steps to the plate. In the dugout, Billy Martin has a sudden idea. He turns to his IBM PC, loads a database with the rules and regulations of baseball, and types a command to search for the keywords "pine tar". In seconds, the answer appears. Billy smiles, rips the hard copy out of the printer, and runs onto the playing field, shouting at the umpires.

As you know, Billy Martin wasn't IBM's first draft pick. Big Blue also dropped its options on Alan Alda, who's now pitching for Atari. Since then, Martin has played ball with some noncomputer companies. Last year, in a television spot for a rug and carpet store, Billy said "I should know about carpets...I've been called on them often enough." ■

Lotus' Symphony Adds New Harmonies to 1-2-3 Modes

Second Lotus product adds windows, telecommunications, full-scale word processing; improves on database and spreadsheet

NEW YORK—On February 14, Lotus Development Corp., the creator of Lotus 1-2-3, sent its customers a Valentine: an enhanced and expanded version of 1-2-3 that will go on sale in July. Called *Symphony*—a name

originally suggested for 1-2-3—the new product features word processing and telecommunications capabilities as well as improved versions of 1-2-3's spreadsheet, graphing, and data base functions.

PRODUCT REVIEW

What's the Tax Advantage?

Now that tax time is here, your PC can help if the software is right

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There it sits, all wrapped up in a neat little package, promising instant relief from the terrible travails of the eternal night of April the 15th, the software siren that suggests it will whip right through your Form 1040 for you, seeing every possible deduction and credit, getting all the arithmetic right on the first printout. Can this be true?

The one on my desk right now is called *The Tax Advantage* from Continental Software Co. and at a list price of \$69.95, if you love computers so much that even calculating your income tax becomes palatable, this program may, just barely, do enough to justify its cost. If you buy it now, the cost will be deductible next year when you do your federal tax return for 1984.

The program lets you enter items, calculates totals and prints out the numbers which you then transcribe onto a Form 1040, a Form 4562—Depreciation and Amortization, or

Schedules A through E, G, SE and W. The schedules cover: A, itemized deductions; B, interest and dividends; C, profit or loss from a business or profession; D, capital gains and losses; E, supplemental income from rents, royalties, partnerships, estates and trusts; G, income averaging; SE, social security self-employment tax; and W, deduction for a married couple when both work.

If you change a number in one of the forms that affects a number on a different form, the program gives you an inverse video signal that you must update the second form. It does not, in the best electronic spreadsheet fashion, enter the updated numbers in all the pertinent places, but it does do some of the recomputing automatically once you make the updating entry on each form.

What *The Tax Advantage* is not designed to do is to complete the whole job if your income picture is embellished with tax preference items, such as stock option profits or large capital gains, that require you to grapple with the 20 percent alternative minimum tax. Maybe next year.

—Laura Lau Meadows, Esq.

Even more exciting, Lotus says, *Symphony* has windows. Lotus spokespeople claim that *Symphony* users will be able to screen spreadsheets, graphs, and documents simultaneously—or, if they like, load selected software packages into memory and transfer useful information from one program to another.

After testing an early version of Lotus' check-full package, one user reported his response was "feature shock."

Like 1-2-3, *Symphony* incorporates a command language that enables individual users to customize the program so that it performs specific applications. Lotus also includes a "learn mode" to assist novices in using the command language.

Lotus says it will market *Symphony* in much the same way that it marketed 1-2-3—through retail stores and value added resellers, as well as direct sales to corporations and software bundling agreements with hardware vendors. Although Lotus won't immediately discontinue the product that made it famous, registered 1-2-3 owners will have a price incentive to turn in their old programs. *Symphony* will cost only \$200 if 1-2-3 is traded in—the difference between the old version's \$495 list and the new model's \$695 list tag.

Lotus president Mitchell Kapur says that 1-2-3 and *Symphony* are "complementary" products, but he admits that 1-2-3 will stay on the market only as long as demand holds.

Kapur hopes that *Symphony* will demonstrate to investors that Lotus will move aggressively to sustain its phenomenal growth. The Cambridge, Massachusetts-based company was founded in April, 1982; it introduced 1-2-3 in January, 1983. In

October, eager investors snapped up the company's initial public stock offering, and by years end 1-2-3 had generated over \$30 million in sales. Lotus, which had 30 employees in January, 1983, now has 345.

Featured instruments in Lotus' five-part harmony include:

- **Communications.** Lotus' package can emulate most ANSI terminals. Using a modem, users send information either to a mainframe or to a compatible PC. Information can be downloaded directly into *Symphony*, so there is no need for reformatting. Users can switch easily back and forth from telecommunications to spreadsheet or any of the other modules. Lotus hopes such flexibility will make *Symphony* a hit in the portable computer market.

- **Spreadsheet.** Lotus boasts that its 8192-row, 256-column spreadsheet is "the largest and most advanced in the industry." The spreadsheet allows the word processing function to manipulate text and data by "speed typing"—setting up formulas for commonly used words or phrases. The spreadsheet also has advanced protection features that prevent errors, ensure user-control password security, and allow users to hide cells.

- **Graphics.** The graphing module features eight types of graphs, including so-called open-high-low-closed charts that track stock prices. With windows, users can arrange displays of several graphs at one time.

- **Database.** The database has mailmerge capabilities and can store up to 8,000 records, some 6,000 more than 1-2-3.

- **Word processing.** *Symphony's* "Wang-like" capabilities are good enough for a stand-alone word processor, Kapur claims. Word processing was widely regarded as the weakest link in 1-2-3.

Like its predecessor, *Symphony* runs on one disk drive. The program requires 320K of memory, however, a hefty increase over 1-2-3's 128K. The package includes a disk-based tutorial (see People in the News), a "getting started" booklet, and reference manuals. ■

Micro-to-mainframe:

Before you settle for solution, ask a few serious



Choosing a micro-to-mainframe communications system is no game. If you make the wrong choice, the consequences can be very expensive.

So before you toy around with "easy" solutions, do yourself a favor and ask some serious questions. You might want to start with these:

Will this product support full IBM Terminal Emulation?

Make sure the system you choose offers full protocol emulation. It should be able to emulate remote batch and interactive IBM terminals and terminal systems.

Does the company offer a variety of products to solve my problem?

The manufacturer you select should be able to handle any operating environment. You should have your choice of stand-alone front-end processors, IBM PC or XT

boards, or an OEM board. And make sure the products will run on the most popular operating systems, including CP/M, MS-DOS and UNIX.

Can I get fast answers to my questions?

Insist on toll-free access to qualified service personnel before and after the sale. A Product Support Group should be available during your normal business day.

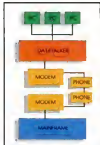
What if I need a quick analysis of a problem?

If you run into a problem, you shouldn't have to sit through a lengthy question-and-answer session over the phone. Ask if the manufacturer has a Communications Test Center that allows for

product testing over public phone lines. And find out if the product has internal diagnostics that point out problem areas right on the screen.

Suppose something goes wrong with the unit?

Be sure the company offers a service plan that includes a 30 day money-back guarantee and a 12 month warranty that includes a free replacement unit.



a simplistic questions.

What about future product development?

It's not enough for a company to solve your communications problems today. Ask about their commitment to R&D. Are they working on products you're going to need soon? If not, you might want to consider someone who is.

Who am I dealing with anyway?

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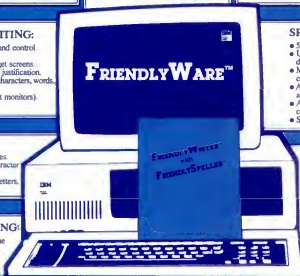
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Eat your Heart out, Johann Sebastian

IBM PCs finally enter the spotlight in product announcements at major music-making equipment show, thanks to MIDI interface.

BY FREFF

ANAHEIM—At this winter's National Association of Music Merchants (NAMM) show at the Anaheim Convention Center in southern California, the noisemakers that drew the biggest crowds weren't pianos or guitars—they were musical computers.

In recent years the hottest news out of NAMM has been the impact of microprocessors on musical instruments. At first used only to make synthesizers more powerful and less expensive, they are now found at the heart of "intelligent" semipro multitrack recording systems, electronic drum kits and programmable drum machines, sound processing devices such as digital delays, and dozens of other products. Then, at the summer 1983 NAMM show in Chicago, the Musical Instrument Digital Interface (MIDI) took center stage.

MIDI was something new in a field known for its obsessive competition. A standard communications protocol for the microprocessors in synthesizers, MIDI would enable a musician to multiply his or her creative power by linking together instruments and computers from different manufacturers. But MIDI, though promising, was only half-realized. A standard existed and instruments with MIDI connections began to be sold, but no software was yet commercially available.

That is finally changing. Two different packages for the IBM PC were demonstrated in Anaheim.

Star of the Show

The software star of the weekend was without question Yamaha's *Personal Composer*, created by Jim Miller (see "Making Music with the Well-Tempered PC," PC, Volume 2

Number 7). To operate it requires an IBM PC with at least 256K RAM, one double-sided, double-density disk drive, a Hercules graphics board, and an Epson FX-80 printer. *Personal Composer* uses a very high-level language that has had hundreds of years of debugging—simply, standard music notation.

Scores of orchestral complexity can be entered from either the PC's keyboard or a single MIDI-equipped synth, and then portions of these scores can be assigned to control as many as sixty-four separate MIDI-equipped instruments. After the tasks of composing and arranging are done, the complete score

can be printed out in extremely clean graphics on the FX-80.

At the moment, only one MIDI-equipped instrument can be used to record and notate at a time. *Personal Composer* will not let your band, say, automatically record a jam session. But Miller has conquered this limitation by designing the system so that it will support a synchronization/network arrangement with one IBM PC and several PC/XTs. This feature will inexpensively allow simultaneous recording of more than instrument.

Yamaha would not specify an exact release date and price for the *Personal Composer* software and interfacing hardware,

but industry observers believe it will run "significantly under \$1000," perhaps as low as \$700. It is expected to be available in late spring.

Best Supporting Act

The other PC package on display at NAMM was the MPU-401 from Roland, a combination of MIDI-interfacing hardware in a standalone box and software that emulates an eight-track recording system, allowing a musician to record and manipulate eight separate and totally polyphonic tracks. The MPU-401 does not offer any kind of music scoring feature, but it does have transposition functions, a built-in metronome, and the capacity for synchronization with external clock sources and controllers. It also has a very reasonable price: \$175 for the MIDI box plus \$100 for the software and an interface card for the PC. It will be commercially available by the end of the month.

The Independents

At the very crowded booth run by the International MIDI Association (IMA), a dozen different makes of synthesizer, drum machine, and computer were all happily interfaced together and making glorious sounds.

It's a sign of the times. The advantages of being able to interface everything in the chain, from instrument to sound modification gear to recording deck and even stage lighting, have become obvious and are being pursued actively by all levels of the musical marketplace, from manufacturer to consumer.

For information on the International MIDI Association and a free membership packet, write to 8426 Vine Valley Drive, Sun Valley, CA 91352. ■

Hacker Spoken Here

The Hacker's Dictionary

Guy L. Steele, Jr. et al
Harper & Row, Publishers
New York, 1983
139 pages, \$5.95

In recent months, a lot of computer humor books have suddenly appeared. We suppose publishers are trying to recapture the magic (and sales) of the bestselling cat books of yesterday.

Most of these books just recycle old jokes—their authors do little more than put PCs in place of cats, preppies, lightbulbs, and elephants. *The Hacker's Dictionary*, however, mines its wit from the authentic folklore of the computer culture. The definitions and examples in this book capture the real-time flavor—and meaning—of hard-core programmers' conversations.

Some of the words in this dictionary—like "bit bucket," "floop," and "hack attack"—are

unique slang terms coined by programmers. Another class of words—"hang," "sacred," and "vanilla"—are used by other English-speaking peoples, but have additional meanings in a computer environment. Other words have official technical meanings—"logical," "random," and "Control-G"—that hackers extend into daily life.

The compilers of this dictionary are native speakers of this standard English superset. The text is flavored by the authors' particular hacker dialect: one heard in major artificial intelligence research centers such as MIT and Stanford University. Most of the terms might spring to the lips of any programmer, but some are peculiar to the LISP language and DEC computers. While we'd like to see a more IBM-specific anthology, we were happy to learn that the plural used for a group of DEC's VAX computers is "vaxen."

—James Langdell

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PC Vacations: Sea and Ski

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In this technologically competitive world, there are some who just cannot enjoy a vacation without thinking of work. We have some helpful suggestions, not only for those industrious zealots, but for people who think computers are just plain fun.

At Jackson Hole, Wyoming, a popular ski resort, guests are taking time off the slopes to learn the practical applications of personal computers. More than simply transforming ski bums into computer jocks, the classes are helping business people overcome their initial intimidations of PC use.

Vacationers are taught word processing, electronic spreadsheets, and DOS commands on IBM PCs. The ten-person classes are housed in condominiums at the Jackson Hole Racquet Club, where 5 nights lodging and 4 days learning will cost \$699 for a family of four. The class alone will set you back \$295 per person.

CLASS Associates of Wilton, Connecticut, is offering similar training on board *The Mississippi Queen*. Riverboat riders are prying themselves away from the poker tables and planting themselves in front of PC monitors. Some learn invaluable information for business, while others just sharpen their video game skills.

Attendees of this week-long computerfest receive hands-on training in word processing,

spreadsheets, and database management. Paying from \$1,495 to \$1,895 for the course, materials, an exterior cabin, and the cruise itself, passengers get to pore over Kaypro, Xerox, Apple, and IBM computers as they paddlewheel pleasantly from New Orleans to Vicksburg, Mississippi.

Open Seas

Turning to wider waters, the magnificent Queen Elizabeth II, flagship of the Cunard Line, is offering free on-board courses in their Computer Learning and Adult Education Center. The 2-hour sessions, held twice daily, are "designed for the computer illiterate," says Cunard's John Whitney. In addition to lectures and hands-on instruction, the Center and software-stocked library are open from 9 a.m. to 9 p.m. for passengers' learning, fun, and experimentation. ■

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No Sure Answers At PC Pow-wow

BY CONNIE WINKLER

PHOENIX—Consternation. While individual vendors are heading bent on their own product dreams, there's little consensus on where the personal computer industry is headed. Indeed, based on 3 days of presentations by the industry's heavy hitters at the annual Rosen Research Personal Computer Conference here, it can only be said that the industry is at a crossroads.

Bill Gates, whose Microsoft played such a key role in the success of the IBM PC, thinks that the personal computer is the workstation of the office of the future—something office automation experts have been saying for a year and a half.

Apple's new CEO, John Sculley, sees the tide moving toward intuitive systems: The best example is Apple's new Macintosh, which he's given 100 days to prove itself in the market.

"The piracy issue is a crock," said Edwin S. Lee, CEO of Pro-Log Corporation, which markets copying hardware. "Because of copy protection," he said, "everyone is inventing the same thing; in overcoming the protection mechanisms, they're duplicating everyone else's work." Lee found himself heavily outnumbered in the audience of about 500, a good many of whom were software developers. He said that the next step would be to price software inexpensively, like semiconductors, so that the pricing curve would stay ahead of the copy cats.

Ironically, on the same day Lee spoke, Lotus Development Corporation started legal action against Rixon, a subsidiary of Schlumberger, for "illegally copying programs and documentation." That suit has since been settled.

And, despite all the industry's hoopla, most users still don't have the "slightest idea what a window is or a mouse, or an icon," said Daniel H. Fylstra, chairman of VisiCorp which is betting on windows and a mouse interface.

And, Fylstra was just one of the speakers calling for more powerful hardware to run today's latest software and supergraphics applications.

These interface schemes all came out about 15 years ago from development work at Xerox's PARC (Palo Alto Research Center), noted Mitchell Kapor, president of Lotus. "PCs today can't do very important, useful work and they are hard to use... We have yet to see the first artificial intelligence product that actually does useful work on the PC."

Mouse Systems Corporation of Santa Clara, California has developed software to overlay packages such as Lotus' 1-2-3 so that the mouse can be used to control the cursor, said the company's president Steven T. Kirsch. But that only increases productivity two or three percent.

Sculley suggested that Unix will be the "logical meeting ground" for IBM, AT&T, and Apple systems—not the present MS-DOS environment. He implied that Apple is talking with AT&T about such possibilities.

Altos Computer Systems chairman David Jackson said Altos sells 2,000 Unix systems a month. When IBM decides what it wants to do with Unix then the standard will be set.

And, he added, what's really needed for personal computers to take over the office is a \$995 PC that runs Xenix (Microsoft's Unix system) and has lots of memory! ■

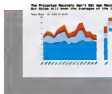
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CIRCLE 113 ON READER SERVICE CARD

In Ad Wars The Biggest Companies Take PCs to the Network Airwaves

IBM, Apple, and other computer giants mount expensive campaigns on TV

BY JEFFREY LENER

NEW YORK—The battle to sell personal computers has moved out of the offices and onto the airwaves. Prohibitive TV advertising costs are separating the industry giants from their poorer cousins and forcing all competitors to rethink their marketing strategies.

A sideshow to the recent Super Bowl was the spate of commercials by computer companies. Apple, IBM, and Radio Shack advertised during the game itself, and an unlikely candidate, the computer-enhancements manufacturer Quadram Corporation, ran a 30-second spot during the less expensive pre-game show.

Smaller Firms Wary

Most smaller firms are wary of sinking such a large portion of their budgets into television. Some, like Mohawk Data Sciences, feel it would be wasteful, since its customers are corporations rather than individuals. So, to introduce its new Hero personal computer, MDS launched a \$3 million domestic print campaign. It ran ads in five trade magazines to reach management information systems and data processing managers ("specifiers") and targeted ads in *Fortune*, *Forbes*, *Business Week*, and *The Wall Street Journal* for higher executives ("approvers").

Compaq Computer Corporation also eschews TV advertising; in fact, it has cut back on its entire promotional budget due to "an inability to meet the demand we already have," says Ken Price, director of corporate communications. Corona expressed similar sentiments: "We don't want to create more demand than we can handle," says Scott Anderson, Abert, New-

hoff & Burr's account executive for Corona. It is relying on a national print campaign to identify the benefits which, Anderson admits, its competitors have as well, but Corona chooses to highlight. "There are no truly meaningful differences to first-time buyers," he says. "It's all just hairsplitting."

Eagle Computer, producer of lower-priced PC imitations, has opted for a unique approach. Starting in mid-February it will be flooding the top 20 markets with 100 local radio spots per week, scenarios set in specific dealerships. This \$6 to 9 million campaign hopes to promote direct local support for dealers, building brand awareness for Eagle and heavy customer traffic for its retailers. "It's a powerful alternative to network and local TV spots that just romance the products," says Eagle Computer's corporate communications director Ron Evans. "In terms of payout on advertising it will be very effective."

Naturally, for those who can afford it, television advertising offers a great many benefits, but also some conspicuous drawbacks. It is an intrusive, high-impact medium with wide-reaching and long-lasting effectiveness. However, it is also enormously expensive, not good for disseminating product information, and very wasteful in its diffuseness. Yet if a firm's revenue base can withstand a television budget, it should give it a try.

The Biggest Take to TV

The two personal computer behemoths, IBM and Apple, have been the most visible and prolific in advertising on the small screen. The recent introduction of Apple's Macintosh has been attended by an innovative and mock-apocalyptic campaign with cinematic and futuristic qualities (see box). Apple justifies this approach by claiming that the Macintosh represents a radical break for the

company. "We have created a whole new product line that is extremely competitive with IBM's products as well as our own older ones," says advertising manager Henry Whitfield.

Meanwhile, IBM's new baby, PCjr, is being quietly promoted as an extension of the PC family. IBM's commercials retain the same character and themes. The tone remains straightforward and warm, emphasizing the high quality and ease of use of this personal productivity tool. "We feel it's been a very effective campaign for us," says communications specialist Rick Scott.

Hewlett-Packard has anted up \$7 million for a primarily television ad campaign promoting its new HP 150 Touchscreen Personal Computer. It hopes to generate awareness of its targeting shift from the scientific to the business user with in-program positioning of HS 30- and 60-second caterpillar-to-monarch butterfly commercials. These product-oriented spots underline that the HP is "not just a me-too micro," says national ad coordinator Jim Eaton, "but a substantially different machine."

Numbers, Numbers

Advertising is a business largely dependent upon demographics, and the effects of broadcasting are often not concentrated enough to reach a target audience. Marketers of personal computers have generally identified the potential customers they wish to reach—middle to upper management or supervisory men earning \$30,000 or more. They have unanimously agreed that there are only a few network programs—sports (except bowling and boxing), news

(continued)

TI Talks Texan



When Texas Instruments' hand-held Type 'N' Talk turned up in toyboxes around the country, people were amused that it generated synthetic speech with

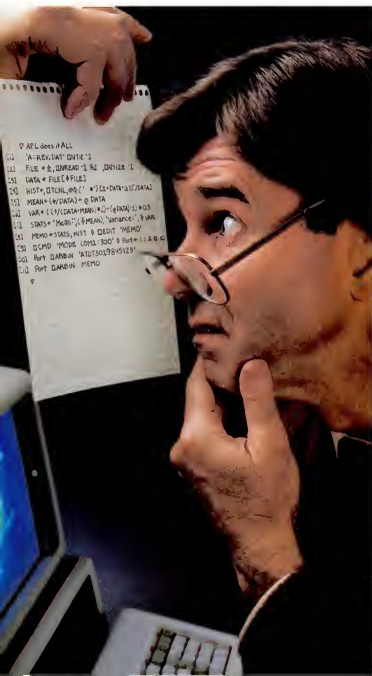
unmistakably Texan inflections.

We've found that TI's software for adults also flaunts the fact that it's Texas born and bred. David Whitehouse told us that the most extreme error message displayed by *TIFORM* (a program for the TI 990 mini-computer) is, "Shut 'er Down Clancy She's a-Pumping Mud."

This colorful message is translated in the *TIFORM* documentation as, "An error has occurred in the *TIFORM* Executor which is not identifiable. Please call the TI customer representative."

TI's programmers knew, to get a true Texan's attention—you've got to start talking oil. ■

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lets you run any of the thousands of CP/M-80® programs available. It comes complete with two of the best programs around, Perfect Writer™ and Perfect Calc.® It's portable. And you can plug it in and start computing the moment you unwrap it.

So if you've been interested in an IBM personal computer, now you know where you can get one for \$1995. Wherever they sell Chameleons.

The Chameleon by



For the location of the Seequa dealer nearest you, call (800) 638-6066 or (301) 672-3600.

CIRCLE 370 ON READER SERVICE CARD

Ad Wars (continued)

and news features shows ("60 Minutes," "Nightline," for example)—that can penetrate this class of buyers. The more specific advertising must be done in print.

The way the two media work best, in tandem, is nearly analogous to softening up the consumers with artillery, then sending in the troops. Television creates an immediate product awareness, company familiarity, and widespread appeal. The print medium then supplies the information a customer needs to differentiate between products and arrive at a purchasing decision.

Sperry Corporation has established an interesting relationship between television and print ads for its new PC. It started with a cartoon in general business and specific industry magazines, with the tagline "When you're late for the party, you'd better have a pretty good reason," and then converted it to an animated television commercial just after Christmas. Of its \$3 million advertising budget for the first quarter of 1984, Sperry allocated \$1.8 million for this television spot and the rest for two print ads.

Sports Wins

This relatively modest budget allows Sperry to cover weekend sports and nightly news, as well as an ESPN series during the Winter Olympics, but prevents it from going head-to-head with the twin titans on the heavy-weight programs. Jeff Houdret, Sperry's advertising manager, reports that for a 30-second commercial during the Super Bowl it cost \$531,000. A similar spot on Monday Night Football goes for \$191,000; on 60 Minutes for \$195,000; and on a regular Sunday NFL game for \$75,000. "This makes it very difficult for other companies to compete, to play successfully in that arena," says Houdret.

So they turn to other methods. Informative four-color inserts can dominate a magazine in a way that a TV program can't be clearly dominated. Radio Shack relies mostly on direct monthly mailings to a database of 50 million cash customers. It

Vendors Design New E-COM Software for Lone PC User

The Post Office's electronic mail service started slowly, but E-COM software makers hope new regulations will boost sales

PC software vendors are gearing up to provide individual consumers with direct access to E-COM, the U.S. Postal Service's Electronic Computer Originated Mail service. If, as planned, the Postal Service dis-

continues its 200-message minimum and adds the option of inserting reply envelopes with E-COM messages, E-COM could develop a much wider following among PC owners.

The Postal Service hoped to

implement the proposed E-COM service changes and rate increases by mid-March, when the Federal Rate Commission was expected to hand down its official approval. If the new regulations help boost the slowly building market for E-COM services, software vendors are ready with products for the PC.

E-COM itself is nothing new. For the last 2 years, the post office has been accepting computer-transmitted messages at the 25 post office branches equipped to handle E-COM. Once the missives have arrived, they are printed out, sealed into distinctive blue-striped envelopes, and turned over to the familiar carriers who trudge the streets on their appointed rounds. The Postal Service guarantees E-COM delivery within 48 hours.

Slow Start for E-COM

Despite the seeming thriftiness and efficiency of using E-COM, however, the service has been slow to catch on. In theory, anyone who has a computer, a modem, and 200 letters to send can use E-COM. In practice, however, using the Postal Service's instruction manuals to write computer-to-E-COM interfaces is far too complicated for most users, and until recently there were few commercial E-COM software packages on the market.

In addition, E-COM followers say, the Postal Service hasn't promoted electronic mail wisely. According to vice president Bob Garber of Digisoft—a New York company that recently began marketing MAIL-COM for the PC—the post office shouldn't have squandered its big ad budget on campaigns in publications like *Time* and (continued)

East Meets West Via Satellite

From 1977, when it introduced the Apple II, through last year, when IBM replaced it at the top, Apple Computers of Cupertino, California had dominated the field of personal computers. IBM and Apple control half the market between them, so when they lock horns in the nation's airwaves, high-tech America may feel the ground beneath it shaking.

During the Super Bowl on January 22, viewers saw the network premieres of commercials unveiling the IBM PCjr and the Apple Macintosh. Charlie Chaplin's Little Tramp, played by Billy Scudder, "affable and sometimes befuddled, but always human," pushed a baby car-

riage representing the new addition to the PC family.

The Macintosh ad was intended as a teaser to "break through the clutter" and rise above the growing crowd of lookalike commercials. And it did. Directed by Ridley Scott ("Alien," "Blade Runner"), it took advantage of the 1984 theme to convey the message that computers can be accessible and don't have to be intimidating. The commercial included 300 catatonic extras enthralled by the voice on a huge telescreen. Was Apple trying to paint Big Blue as Big Brother? No, says Apple, it was just sticking with its longstanding principle of "democratization of computers."

—Jeffrey Lener

uses the mass media as well, with a three-to-one print-to-television ad budget, but, says David Beckerman, vice president for advertising, "We can't compete dollar for dollar in any medium. We have to compete with quality products and servicing." Radio Shack does this through a nationwide network of computer centers, service desks, and educational facilities.

The exponential increase of personal computers on the market, coupled with the escalating expense of advertising these products, has necessitated that industry members modify their

approaches. Companies that can bear the expenditure are using a mix of television and print advertising, one for imaging and the other for the nuts and bolts. Smaller concerns are forced to turn to other outlets—radio, local newspapers, dealer co-op packages—where they can attain a significant rather than a marginal presence. Although finding cost-effective means to leverage media spending may be difficult, a creative campaign can help secure a louder voice in this burgeoning industry and a larger share of its profits. ■

Next April 15th, you could be adding up your golf score instead of your taxes.

With your IBM PC and Best Programs' TaxCut™ program, you can use the long days and nights you used to put into preparing your taxes for something more enjoyable.

TaxCut includes two second-generation programs, one for tax preparation and the other for tax planning, pioneered and refined by tax and programming experts—and by PC users like you. With step-by-step, on-screen prompting, the tax-preparation program helps you prepare and print the 1040 long form and more than 30 other commonly used forms and schedules.

You don't have to know all the regulations. You don't have to figure out IRS instructions. If you need help, the on-screen prompter tells you exactly which page in the comprehensive reference manual

has the answer. You won't waste time answering questions more than once because the program automatically transfers information from one tax form to another.

TaxCut also includes a tax planner program that allows you to decide for yourself whether or not to set up an IRA, what effect a new mortgage will have on your tax liability, and the tax implications of a wide variety of other financial alternatives.

TaxCut is compatible with the IBM PC, the PC/XT and the COMPAQ computer. The program requires at least 128KB memory and one double-sided diskette drive. Add Best's Professional Finance Program (PC/PFP1), which tracks and computes data for input into TaxCut, and you have a complete financial and tax package.

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The TaxCut program is available for immediate delivery. Call us toll-free at 1-800-368-2405 for more information.

Next April 15th, you'll be very glad you did.



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CIRCLE 215 ON READER SERVICE CARD

E-COM (continued)

Newsweek. "For a fraction of the amount they would have done better in computer magazines," he says. "They were spending their money on the wrong people."

Originally, the post office envisioned that E-COM service would be best suited to large corporations doing bulk mailings. When the service was started, however, big companies weren't interested. "The business community was slow to recognize the advantages of word processing and personal computers. In the same way it has been slow to understand the intricacies of electronic text processing, of which E-COM is a part," says Diana Guetzkow, president of Network, Inc.

As founder of Network, based in Riverdale, Maryland, Guetzkow was one of the first entrepreneurs to see the business potential of processing E-COM messages for companies unwilling to purchase their own E-COM software or unable to meet the 200-message minimum. Network sent the first commercial E-COM message on January 4, 1982, and has sent more than 200,000 letters since. (The company also markets E-COM software for the PC.)

Clients who submit materials to Network for electronic formatting and transmission usually pay about 60 cents for each letter they send. Other electronic-service companies, like Western Union and The Source, will also piggyback individual users into E-COM—but they may add stiff service charges for the favor. In addition to their normal costs, subscribers to The Source are billed \$1.35 for the first page and 25 cents for the second page of E-COM transmission. By comparison, a letter sent directly through E-COM costs 26 cents for a single, 41-line page; a second page costs a nickel more. Once rate changes are approved, E-COM's page rates will jump to 31 cents and 9 cents, respectively.

By late last year, companies that were reluctant to pay constant service charges or design their own E-COM software were turning to computer con-

sultants and software design firms for help. "As it turned out, small users were the ones who were using E-COM, not big companies," says Garber. Everyone wanted software, and they were coming to people like us to write it," he says.

Confusing Documentation

Dr. John Fogle of South Carolina's Fogle Computing Corporation, author of the P-COM (a PC-to-E-COM package), claims that E-COM's bad documentation has been a boon to software developers. "The Postal Service put out a 120-page document describing the format [according to E-COM specifications for end-users]; it is absolutely the most gruesome thing you could ever read. And even if they had written a good manual, the syntax rules for E-COM are pretty dismal," Fogle says. In response to such complaints, the Postal Service is reportedly revising its technical manuals.

No matter what they cost, manufacturers of all of the new PC-to-E-COM packages claim that they're extremely user-friendly. Among the products we've heard of, but not seen:

***The Postman**, \$44.95 from Sydney Dataproducts, San Diego, CA. (619) 231-1775. *The Postman*, which allows users to call Western Union's E-COM service, has a small text editor to alter letters and a 30-entry address file. "We're after people who have a PC and want a useful little utility. If customers don't like it, they won't hate us, because we didn't charge them an arm and a leg for it," says Jim Seagrims, retired Sydney president.

***MAILCOM**, \$195 from Digisoft Computers, Inc., 1501 Third Avenue, New York, NY 10028. (212) 734-3875. Like several of the more expensive E-COM products, *MAILCOM* has some text editing functions and interfaces with *dBase II*, *WordStar*, and *MailMerge* files.

***P-COM**, \$225 from Fogle Computing Corporation, 357 E. Blackstock Rd., Box 5166, Spartanburg, SC.

***The Ultimate**, \$385 from Computer Creations, Inc., 766 El Camino Real, Suite D, San Carlos, CA. (415) 595-4466. ■

PRODUCT REVIEW**Word Processing
The Manual Way**

The McWilliams II Word Processor Instruction Manual (\$3.95)

Word Processing on the IBM (\$9.95)

Questions and Answers on Word Processing (\$9.95)

Peter A McWilliams
Prelude Press
Box 69773
Los Angeles, CA 90069

Already, the history of micro-computing repeats itself. Adam Osborne first made his name in the computer business as a writer and publisher of books on designing and programming microcomputers. Then he entered a new career by designing and marketing his own computer: the Osborne 1.

Peter A McWilliams has followed in Adam's steps. After writing six books on personal computers and word processing and publishing them through his

own Prelude Press, McWilliams applied his experience and name to a new product: the McWilliams II Word Processor.

For his books, McWilliams investigated many word processing programs and the personal computers that make it possible to write in these modern times. After trying them all, McWilliams thought, "There's got to be a simpler way to process words." He found a simpler way: the McWilliams II. Admittedly, this word processor looks a lot like a pencil. But how can the product be no more than a pencil if it needs 144 pages of documentation for support?

The McWilliams II Word Processor Manual is packed with operating instructions for using the McWilliams II (including the "deprocessor" at the back end of the system), compatible peripheral devices (such as

(continued)



The McWilliams II Word Processor provides an embedded, on-line help function that's always close at hand to users. The eraser function, however, is optional.

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Manual (continued)

"sharpeners"), and hundreds of applications illustrated by photographs showing the role of the McWilliams II throughout history.

The manual's list price is \$3.95. Figured in pennies-per-laugh, it's a bargain for a joke book—quite an improvement over McWilliams' two previous books.

Questions & Answers on Word Processing, a disappointing sequel to *The Word Processing Book*, seemed like McWilliams just packed up everything that was sitting on his desktop after his first year of celebrityhood and sent it to the

typesetters. The new volume had lots of throwaway gags that might delight members of the McWilliams Fan Club, but it's rather light on information that might inform the unconverted.

Playing Off IBM

His other recent book, *Word Processing on the IBM*, was an IBM-specific retread of his generic word processing book. Aside from reprinting most of the chapters from his earlier book, McWilliams offers information on over 50 word processing programs for the PC. Rather than condensing the results of his research into a few raving recommendations and

witty warnings, as he has in the past, McWilliams left his findings undigested and just published a pile of checklists. Why is McWilliams so uninspired in this book? "I do not use an IBM," he reveals in its pages. "I do not plan to use an IBM in the near future.... I like what I've got." His apathy shows through on every IBM-specific page.

Since he's his own publisher, there's nothing to stop McWilliams from releasing a self-indulgent book occasionally. But this arrangement allows him to get books into print faster than more traditional publishing houses can, which gives him the advantage of being

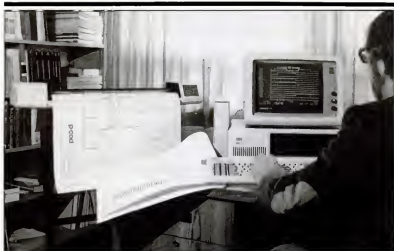
more up-to-date. For instance, the McWilliams II manual included several jokes about the Osborne Computer Corporation declaring bankruptcy—and this book was on sale only a month after the news story broke.

Since Peter McWilliams has written so many cheap shots at Adam Osborne, perhaps it is inappropriate to draw parallels between the two personalities. McWilliams could also be compared with another American who was a poet, author of a self-help book that inspired thousands of people, and had a career as a self-employed pencil maker—Henry David Thoreau.

—James Langdell

Calendar of Events

DATE	EVENT	COMMENT	LOCATION	CONTACT
May 3-6	Personal Computer Userfest	Featuring Apple and IBM PC computers and compatibles.	O'Hare Exposition Center Chicago, IL	Northeast Expositions 822 Boylston St. Chestnut Hill, MA 02167 (800) 343-2222 (617) 739-2000
May 10-12	Byte Computer Show	Hardware, software, and accessories.	McCormick Place Chicago, IL	The Interface Group 300 First Ave. Needham, MA 02194 (800) 325-3330 (617) 449-6000
May 22-25	COMDEX/Spring	Hardware, software, and accessories for dealers and retailers.	Georgia World Congress, Atlanta Apparel Mart, and Atlanta Merchandise Mart, Atlanta, GA	See above
May 22-26	MICRO-EXPO	International hardware and software trade show.	Palais des Congress Paris, France	In U.S.: MICRO-EXPO 2344 Sixth St. Berkeley, CA 94710 (800) 848-8233 (415) 227-2346
June 12-14	Advanced Manufacturing Systems Exposition & Conference	Information systems and automated production systems.	McCormick Place Chicago, IL	AMS 84 708 Third Ave. New York, NY 10017 (212) 370-1100
June 14-17	Cincinnati Computer Showcase Expo	Hardware and software.	Cincinnati Civic Center Cincinnati, OH	The Interface Group See above
June 26-28	PCExpo	IBM PC and compatible trade show.	New York Coliseum New York, NY	PCExpo 333 Sylvan Ave. Englewood Cliffs, NJ 07632 (201) 569-8542



CAD Turns Friendly with PC For Architects, Designers

Personal CAD Systems harnesses PC for design with snazzy graphics database and Mouse Systems cursor control

BY CONNIE WINKLER

LOS GATOS, Calif.—"Ease of use" is a tired, tired cliché to most PC users, but to architects and facilities managers—and now printed circuit designers—it's refreshing news.

Giving an architect the ability to reposition a sink on a floor plan at the touch of the mouse cursor-control device has tremendous impact on the designer's productivity, explains Richard A. Nedbal, president of Personal CAD Systems, Inc. (PCAD).

"PCAD systems are designed for usability," said Nedbal, who has over 15 years of experience designing and using microcomputers and working on computer-aided design (CAD) systems. "We were a bunch of users; we designed the system we wanted; we took the personal computer... generally more friendly... point of view." CAD (computer-aided design) and CAE (computer

aided engineering) systems usually run on mini or mainframe computers and thus are usually more complex.

PCAD's two products for the IBM PC so far are *CADPlan* and a group of printed circuit board design programs, grouped under the name Electronic Design Automation (EDA). The company is currently adding a tutorial package, *CAD-Mate*.

Designing Daughter

PCAD is Nedbal's baby—so much so that his daughter (12 years old at the time) helped program some of the graphics when Nedbal was first working on the program in his home (see related story). The two-year-old firm has about 50 employees and hesitates to reveal sales.

CADPlan was released in late 1983 and early this year PCAD here unveiled its EDA integrated printed circuit board design packages.

The three key packages—*PC-CAPS*, *PC-CARDS*, and *PC-LOGS* integrate engineering and design from schematic entry through logic simulation to board design. The packages are linked by a common database, *Integrated Intelligent Database* (IID), so that each person in the design process works with the same information—assuring accurate designs and improved productivity. The PCAD configuration can be pulled together for about \$15,000, within the reach of small engineering and design companies, Nedbal said.

Product Line-up

• *IID* tracks electrical and logical connections, device attributes and other electrical data.

• *PC-CAPS*, the schematic capture system, lets an engineer develop designs at the logic level using a hierarchical methodology. *PC-CAPS*, which op-

erates in up to 16 colors and with 50 design layers, can handle up to 1,000 components and 1,000 nets at each level of the design hierarchy.

• *PC-LOGS*, a 12-state, event-driven logic simulator, can handle up to 5,000 elements. The net list produced by a *PC-NODES* utility or other source is input for *PC-LOGS*. Circuit behavior can be displayed in several forms, including color graphic waveforms such as those monitored by an oscilloscope or a logic analyzer. The software simulates logic, MOS, and bipolar circuitry, as well as complex devices such as ROMs and RAMs.

• *PC-CARDS*, the layout package, creates printed-circuit boards by three methods: digitizing from an existing layout, creating a design on the system from a hand-drawn schematic, or starting from an existing net list created by *PC-CAPS* and *PC-NODES*.

• *PC-NODES*, one of three utility packages, is the net list extractor. It extracts lists of elements and the connectivity between elements from databases created by *PC-CAPS* and *PC-CARDS*. It's a non-graphics representation of the design and provides complete information about the circuit topology as well as any attributes pertinent to the circuit's operation. The other utilities create plots and photoplots.

Separately, *PC-CAPS* sells for \$3,500; *PC-LOGS* for \$2,500; and *PC-CARDS* for \$4,500. *PC-NODES* is \$500. The EDA software requires 512K of RAM and two floppy disk drives.

2-D Design

The other design product, *CADPlan*, is for two-dimensional design applications such as floor-plan layouts for office buildings, placement of furniture or equipment in industrial building, or designing mechanical systems. For example, it displays on the PC screen a grid identical to quadrille paper. Designs can be handily drawn with a cursor-control device such as a mouse or digitizing tablet.

CADPlan commands—dis-
(continued)



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CIRCLE 176 ON READER SERVICE CARD

CAD (continued)

played on menus—include ZOOM, PAN, COPY MOVE, ROTATE, DELETE and UNDO, which are readily recognizable from larger CAD systems. Users can pan around an object drawn on the screen for a global view and zoom in or out of a particular area to check details.

CADPlan is fast because information is stored in integers instead of floating point notation. This allows "real-time dragging of images," Nedbal explains. Images—a chair, sink or toilet, for example—can be moved across the designing screen as if they were being dragged across the office floor.

Key Features

At the heart of **CADPlan**—and one of its best features—is its optional database manage-

ment system that keeps statistics on design components. An architect can, for instance, ask the system to total the number of desks that will be needed for an office building design.

With another key function, cost-analysis, a facilities planner could build a database of vendors, devise the office plan, and produce the bill of materials for chairs, desks, bookcases, or whatever. With **CADPlan** a user can place components on as many as 65 different layers, as if transparent overlays were used.

Equally important, a symbol library of frequently used items—desks, windows, electrical outlets—can be created and the symbols reused in new designs. **CADPlan** also produces scaled output on a printer or plotter so that an entire design or any portion of it can be printed or plotted. ■

14-year-old Leah Helps Out Dad

When programming an innovative computer-aided-design (CAD) application developed into full-time, serious work and ultimately a new company, 14-year-old Leah Nedbal of Los Gatos, California lost interest.

Two years ago, however, it was fun. She and her father worked together on the initial programming for a printed circuit design package for the PC.

"She and I were partners," recalls her father, Richard A. Nedbal. "I'd give her a portion of a graphics design and she'd go off and write code."

Leah was familiar with graphics programming because of some of the computer games she'd designed on her home computer. The CAD package was written in Compiled Basic and her programs converted vectors to graphics.

But Dad had bigger ideas. Besides the CAD and CAE (Computer Aided Engineering) programming, he was pulling together venture capital to start Personal CAD Systems, Inc., one of a handful of companies now offering CAD packages for the PC.

"When it became apparent I was going to start a company, she lost interest."

Today Leah's computer is relegated to homework assignments. "If it doesn't ski or isn't male, she's not interested," says Dad. ■

Windows on the Nation



Drawing by Lewis. © 1984 The New York Magazine, Inc.

PRODUCT REVIEW

In the Know with Super-Tabs

Siechart & Wood Technical Publications
133 W. Colorado Blvd.
Pasadena, CA 91105
(213) 449-1276
List price: \$9.95

Could you get excited about a set of page dividers? For \$9.95? We could. After first dismissing *SuperTabs* as the answer to a question that nobody asked, we took a closer look. In addition to neatly categorizing your DOS and BASIC manuals, they are imprinted with information that can be very useful if you do much in the way of programming. The information is in the manuals too, but on the *Super-Tabs* it has been culled out, simplified, charted, and graphed for ease of use. For example, the divider labelled ASCII Codes has neat graphic examples of the PC's graphic characters, arranged in boxes and patterns that make it a snap to draw forms on the screen.

SuperTabs are distributed by: Micromedia Marketing, Inc., 61 S. Lake Ave., P.O. Box 60550, Pasadena, CA 91106 (800) 423-4265 (818) 795-9646.

—Bill Machrone

BASF Qualimetric FlexyDisks feature a unique lifetime warranty, firm assurance that the vital information you enter on BASF FlexyDisks today will be secure and unchanged tomorrow. Key to this extraordinary warranted performance is the BASF Qualimetric standard... a totally new set of criteria against which all other magnetic media will be judged.*

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CIRCLE 138 ON READER SERVICE CARD

*Contact BASF for warranty details.

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People in the News: Marcia Zuckerman

For the former teacher who is writing Lotus' *Symphony* tutorial, electronic instruction is serious business. For this disk, she says, dancing ladies need not apply

BY KAREN COOK

When Lotus Development Corporation introduced its *I-2-3* financial software to the world in early 1983, company executives boasted about the product's accompanying tutorial as if it were the hottest thing since sliced bread. And, in a way, it was: Lotus was the first company to ship an instructional disk with its software.

Now Lotus hopes to repeat the success of *I-2-3* and its tutorial with *Symphony* and its sidekick tutorial program. Last fall, Lotus hired former teacher Marcia Zuckerman as the sole author of its second set of disk-based lessons.

Like the *Symphony* program itself, the tutorial will be divided into five modules—database, spreadsheet, graphics, word processing, and telecommunications. Each module is independent, so users can study the program in any order they please.

PC talked to Zuckerman in Lotus' pleasant oak-and-plant furnished offices in a renovated glue factory building in Cambridge, Massachusetts, last January—a month before *Symphony* was announced.

PC: The product isn't even finished yet—do you write the tutorial as you go along?

ZUCKERMAN: Revised versions of the product come out every couple of weeks. I write about each new feature as it comes out, and then I go back and make necessary changes in what I've already done. We play a lot of catch-up.

When a company like Lotus is coming up with a new product, management has to walk a line between creativity and structure. There's a kind of loose-tight balance: On one hand, programmers need creative freedom. You have to let

them use that brilliant inspiration in the bathtub and then stay up all night working on changes that will make a much better product.

On the other hand, after a certain point, brilliant inspirations simply won't be allowed any more—they'd wreak havoc in scheduling down the line.



PC: What things do you keep in mind as you write the program?

ZUCKERMAN: I have an overview of what the product is going to do, so I keep in mind how many lessons I'd like to have for each area of the program and what skills I want to cover in each lesson. The script is written like a manual, in English, but I try not to write more than one text screen in a row without giving people a chance to press a key. That rule limits the amount of space I have to explain what will happen when they do. Often my explanation doesn't fit exactly on the computer screen, so I have to cut out words. That can be frustrating.

I try to make the tutorial's instructions very consistent—people should never be surprised by new information when they look at their screens.

PC: Do you test the tutorial to see if it works?

ZUCKERMAN: Yes. As new

employees start, I set them up with a version of the tutorial and ask for criticism. Sometimes they tell me my explanations are just too compressed. Other times I've let the basic vocabulary of the program creep in automatically, without explanation—like "cell," which is the standard term for the unit on the spreadsheet that you put information into.

PC: How did you wind up with this job?

ZUCKERMAN: One of my courses [at Harvard's Graduate School of Education, where she got a master's degree in 1983] made me very interested in computers and education. Computers were not completely out of the blue for me—I had taken programming courses in high school and college that were fun. I had even thought of becoming a programmer, but the job seemed too isolating. I wanted to do something that really involved people.

And then, as the first step in a long story, a counselor at Harvard suggested I look into computer training in industry. I had a lot of doubts about moving from public service to the corporate world, but I wound up talking to a man who was looking for technical writers on a project for Lotus. He decided to try me.

When I sat down in front of the first *I-2-3* tutorial and used it, I had a very clear set of reactions about what I liked and disliked—even though the material was completely foreign to me. Those reactions came from my experience as a teacher, but they were clearly relevant. That convinced me that writing a tutorial was something I could do.

PC: Are there limitations to the tutorial as a teaching tool?

ZUCKERMAN: Yes. The tutorial simply doesn't allow people to make mistakes. If you

press the wrong keys, the computer just beeps.

My answer is to suggest that people play with *Symphony* for themselves. They can learn a lot by experimenting on their own.

PC: How do you make the tutorial entertaining?

ZUCKERMAN: I'm not sure that a lot of entertainment is appropriate as teaching this program. I try to maintain a friendly, personable tone—but I don't want to be cutesy. I don't like personifying computers—that's giving the wrong impression of what the machine is. People should learn to think of computers as tools.

PC: What about using fancy graphics?

ZUCKERMAN: Yes, when graphics serve a purpose—but again, a lot of times graphics can be a chance for the program to show itself off without teaching anything useful about the product.

Actually, I hope that *Symphony* is of enough genuine interest that you don't need to graft anything onto the learning to make it more palatable.

It's fun just to show off what the product normally does. When you tell someone to press a key and watch all those numbers change, that's a wow in and of itself. People are using the tutorial to understand the new Lotus product, so they really want to see *Symphony* work. They don't need to see dancing ladies running across the screen.

To me, the most important thing is that people are not just pressing keys because the tutorial told them to. I want people to really understand why they are pressing those keys and what happens when they press them. If they understand, then I have succeeded. ■

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Computer Equality for Women

To ensure full participation in the computer age and to make computers work for all of us, both women and men must fight sexism in the expanding field of personal computing.

At lunch the other day, someone mentioned a recent *New York Times* article by Barbara Schoen that described the prejudice she encountered in computer salespeople. They seemed unable to accept that a middle-aged woman could be computer literate. This comment elicited one war story after another from my companions. One was about a salesperson who responded impatiently to one woman's specific questions about several machines; another was about a salesperson who immediately lost interest in a female customer when she admitted that she wanted the computer only for word processing. I'm also involved with computers; why didn't I have similar tales to tell?

Mainframe Equality

I realize that my experience in a mainframe business environment has given me a more optimistic sense of how people view women and computers. In corporate data processing shops, there is much less prejudice against women than my lunch companions have found in the personal computer field. Nonetheless, there are two areas in which prejudice can still be found in corporate computing: in management, the bastion of power, and in systems programming, the most technical specialty in business data processing.

I believe that women will continue to make inroads in these two areas, just as



Stephanie Stallings

they have become full participants in every other area of mainframe data processing over the last 20 years.

This equal participation has come about without fanfare, in part because the computer industry is so new and has, therefore, little history to overcome. More importantly, it has come about because in data processing, the basis for advancement is skill, not sex. When people need help with a problem, they go to the person who can help. The need and respect for expertise tends to override prejudices against women who do technical brainwork. In a mainframe shop, there are too many different applications areas for any one person to become an all-around expert. Companies simply can't afford not

to rely on the knowledgeable person.

Since personal computing is a new field with new people, it will have to go through its own educational process. Those people, more often men, who do not believe women are competent in technical fields, will begin to change their views when they must turn to computer experts who are women. Women who still doubt their own technical capabilities will gain confidence from the example of others and from their own growing skills.

One difference between the mainframe and micro fields is that while a mainframe programmer can specialize in certain applications, the PC user must be several people at once: a manager who decides how the PC will be used, an applications programmer skillful with several software packages and/or languages, a systems programmer able to do patches and diagnose problems, and a field engineer ready to wield a screwdriver, set switches, and install chips.

Many men, as well as women, back away from this jack-of-all-trades challenge. Women, especially, may doubt their own technical capabilities because society doesn't encourage them to investigate the workings of electronic gear or mechanical hardware. People around them may even laugh at women who roll up their sleeves and delve into a PC's innards.

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EDITOR'S SCREEN

This same prejudice hinders women who tune their own cars or wire a light socket. The popular supposition is that there's something unfeminine about these activities. But really, what's the big deal?

Making Changes

Despite the prejudice, a sharp observer can already spot signs of positive change. A radio advertisement for Dow Jones' financial software is announced by a woman who says she uses the company's technical analysis package. A television commercial I saw recently showed a little girl receiving a personal computer for her birthday.

When We Are Ready

Further changes are needed. Advertisers and computer magazines should refrain from running sexist ads or photographs. One example of what we could do without is Peachtree's "A Star is Born" ad campaign, in which a succulent-looking cartoon peach is shown dabbing on the final blush at "her" backstage dressing table before going out to wow the audience. Another example of the demeaning representation of women in the computer field is *PC Magazine's* own August, 1983 "bimbo" cover, which was brought to you by some people who should know better. That was the cover on which the suggestively dressed and posed teacher was educating her students in the fine art of—something. Sorry, guys: women's position in society is not yet at the point where this sort of thing can be done without causing harm. (Although when we do get there, I'll vote for the Olympic athlete who models the Calvin Klein underwear.)

Computer advertisements and editorial coverage in the mass media should present men and women in equal numbers. Already, many computer users happen to be women; this trend should encourage more women to give computing a try. The media should depict similar attitudes toward computers among women and men, rather than presenting husbands as the

confident consumers and wives as uncertain creatures who, with coaxing, might learn to use the computer just a little.

A number of women have reported, like Barbara Schoen, that they have been ignored or treated in a patronizing way in

We are now in a period of profound technological change, a fact that the personal computer is literally bringing home to many people.

computer stores. Store managers should realize that in treating their women customers this way they are doing the greatest disservice to themselves. No woman will ever buy from a store that treats her disrespectfully.

Gaining Computer Confidence

Self-respect and self-confidence in the use of computers are best learned when the seeds are planted early in life. For this reason, we need more computer games that will appeal to young girls. For starters, I'd like to see a version of the laser cartoon adventure game, *Dragon's Lair* (by Cinematronics), in which the protagonist is female, and which does not feature the traditional maiden in distress passively waiting to be saved. (It's always a nice irony to see a girl racking up points in one of these games.) Sports games, such as Micro-Soft's *Decathlon*, are particularly good for girls because they encourage risk-taking. Since girls tend to develop verbal skills earlier than boys, many of them might enjoy more of the verbal adventure games, such as the *Zork Trilogy* by Infocom, which is a series of three treasure-hunt games.

One suggestion that might help pro-

mote computer literacy among girls would be to make traditional "girls'" activities the basis of computer games or programs. For instance, a program for designing dollhouses might include representations of architectural elements, which would be an introduction to computers, spatial concepts, construction, and design.

To gain computer self-confidence, all of us must learn not to presume about our own or other people's ability to learn a new skill or about whether we will like the new skill. Such presumptions are the building blocks of the status quo. It's important to differentiate among not liking a new tool, being afraid to try it, and lacking the innate ability to use it. The time will surely come when we'll want these computer tools at our disposal.

Women already in the industry can serve as role models to other women in their organizations and to younger women they know. They should encourage other women to test out the field, because women are likely to find more long-term, open-ended career opportunities in computing than in a number of other professions.

We are now in a period of profound technological change, a fact that the personal computer is literally bringing home to many people. At the same time, the prevailing political wind is blowing us back toward a prefeminist social climate. It is up to concerned individuals to make a continued, if uphill, effort to consider and incorporate the needs of diverse groups into our increasingly computerized society as it evolves. The slow progress of the civil rights and women's rights movements has already shown us how difficult it is to alter the situation. If we don't accept this responsibility in the computer field, we may see our civil rights gains in other areas gradually slip through our fingers.

Computers are the driving force of our age. Each of us needs to be informed about and conversant with them to participate as full members of society and to make computers work for all of us. ■

Practical Printers at Prudent Prices

Dot Matrix

Printer compatibility with the IBM PC marches on, in addition to the Quidata Microline Series with Plug-N-Play, the C. Itoh Prowriter now comes in a new version the BPI that's compatible with the IBM PC (see below). So what's keeping the rest of the manufacturers?

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95008	\$1119.88
95018	\$1119.88
95208	\$1209.88
96258	\$1309.88
WP-6000	\$2359.88
WP-6500	\$2599.88
WP-6500/6500 Tractor	\$139.88

C. ITOH

Prowriter 1 & 2 Prowriter BPI Prowriter SP



C. Itoh's Prowriter (120 cps) features 10, 12, & 16 cps, a proportional/ correspondence quality font, double strike, double-width, sub/super scripts, dot graphics (180 x 144 dpi) & friction/ tractor feed.

The Prowriter BPI offers code compatibility with IBM-PC block/dot graphics codes, & it has all the features of the Prowriter. A nice move.

The Prowriter SP has faster print speed (180 cps), true sub/superscripts and italics. A new printer with nice features.

Prowriter	\$379.88
Prowriter 2	\$809.88
Prowriter BPI	\$479.88
Prowriter SP	\$519.88

EPSON

RX/FX Series	\$CALL
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IDB/DATA PRODUCTS

P480	\$439.88
Prism 132	\$1489.88
w/4-color	\$1699.88

INFORUNNER

Riteam	\$339.88
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MEMOTECH

DMX-80



A dramatic black printer The DMX-80 (80 cps) features 10, 12 & 16 cps, italics, double-width, half-width, enhanced bold print, dot graphics (120 x 144 dpi), friction/tractor feed. Comes with a 4,000,000 character ribbon. Epson code compatible in text mode. Inexpensive in graphics. Quiet printing & a sharp design make it ideal for home or office. The DMX-80 is serviced by Panasonic.

DMX-80	\$339.88
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OKIDATA

Microline Family



The Okidata Microline family offers IBM-PC users a wide range of features for almost any application. All Microline printers are made with the same rugged materials and care. No matter which printer you select, you've chosen one of the best printers made.

The Microline 92 (180 cps) is ideal for word processing. It features 10, 12 & 17 cps, a correspondence font, double-width, emphasis/boldface, sub/super script, underlining, pin/friction feed (tractor is optional on the 92) & dot-addressable graphics (120 x 144 dpi). The 93 is the 136 column version. Parallel interfaces are standard; the RS-232C interface is optional.

The Microline 84 (132 cps) is the Step 2 version, featuring 200 cps at 10, 12, & 17 cps (w/double width), all with a correspondence mode & dot addressable graphics. Parallel or RS-232C interfaces available.

A new PROM called PC Plug-n-Play turns a 92, 93 or an 84 into an IBM PC compatible printer, with full capabilities. You will sacrifice a few features (like 12 cps) but the PROMs are worth it if total compatibility is your goal.

The Microline 82A (120 cps) is a data cruncher. Features 10 & 16 cps (5/8 double-width). Dot addressable graphics are optional. The 83A is the 136 column version.

Microline Series	\$CALL
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MT-180 L	\$629.88
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Quidnet	\$CALL
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STAR MICRONICS

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Delta 15	\$599.88
Radix 10	\$629.88
Radix 15	\$739.88

TOSHIBA

P-1350	\$1799.88
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Letter Quality

C. ITOH

A10 Starwriter F10 Starwriter F10 Printmaster



The C. Itoh Starwriter (40 cps) features 10 & 12 cps, sub/super script, underlining, & 8 lpi. Quidata code & Cidbit supplies. The A-10 Starwriter has the same spec, but it's slower (20

cps). The Printmaster has the same spec, but it prints faster (55 cps). Both the Tractor Feed & the Sheet Feeder fit all three models.

A-10 Starwriter	\$599.88
F-10 Starwriter	\$1119.88
F-10 Printmaster	\$1489.88
Tractor Feed	\$219.88
Single Bin Sheet Feeder (A10/F10)	\$619.88

COMREX

CR-2	\$509.88
CR-2 Tractor	\$89.88
CR-2 Sheet Feed	\$189.88

DIABLO

620 (RS-232C)	\$939.88
630 (PC)	\$1999.88

OTC

OTC 380Z	\$1199.88
Tractor Feed	\$149.88
Sheet Feed	\$619.88
Style Writer	\$759.88
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Sheet Feed	\$279.88

NEC

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3530	\$1699.88
3550	\$1859.88
2000/3500 Tractor	\$239.88
2000/3500 Sheet Feed	\$479.88
7710/7730	\$2199.88
7700 Tractor	\$379.88
7700 Sheet Feed	\$619.88

QUME

Spint 11/40	\$1559.88
Spint 11/55	\$1789.88
Tractor Feed	\$219.88
Sheet Feed	\$619.88
LetterPro (20cps)	\$CALL

SILVER REED

EXP-550/500



The Silver Reed EXP-550 (17 cps) is a 132 column letter-quality printer with 10, 12 or 15 pitch, sub/superscript, underlining & true Oblio 1610 emulation, making it compatible with most word processing software. It's friction fed, & it features a page inceptor, an optional tractor is also available. The EXP-500 (12 cps) is a 100 column letter-quality printer with the same spec as the EXP-550, but slower & without page eject or proportional spacing.

EXP-550 (Parallel)	\$809.88
EXP-550 Tractor	\$129.88
EXP-500 (Parallel)	\$649.88
EXP-500 Tractor	\$119.88

SMITH-CORONA

Messenger

The Memory Correct II Messenger combines an electric typewriter and a letter-quality printer. It features 12 cps, 3 pitches (10, 12 & 15), variable line spacing, 10.5" writing line, variable backspacing & auto-correction. It comes complete with parallel/serial interface.

Messenger	\$569.88
-----------	----------

STAR MICRONICS

PowerType

The PowerType (17 cps) has 110 columns (11" print line), 10, 12 & 15 cps, proportional type, auto/superscript, backspace/underlining & Oblio 620/830 code compatibility. A nice printer for the price.

PowerType	\$359.88
-----------	----------

Accessories

Printer Stands

Heavy-gauge steel with a baked enamel finish (beige), with a pivot slot in the center for bottom feeding. Fits 10 or 132 column printers (specify).

60 Column Stand	\$39.88
132 Column Stand	\$49.88

Microfazer

Printer buffers from 8K to 512K, in parallel/serial or configurations. These are stand-alone units with a pause feature and copy/clear buttons. User-adjustable Power supply included, but the cables are optional.

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64K P/P	\$169.88
128K P/P	\$239.88
256K P/P	\$549.88
512K P/P	\$769.88
Male-male cable	\$29.88

Cables

Printer cables for the IBM PC, IBM PC/XT, Compaq, Columbia MPC & VP, Eagle-PC/Spint and many others, as well as 9 wire modem cables. All cables are

cables	\$29.88
--------	---------

Printer Switches

2-Way & 4-Way switches for 36 pin Centronics or 25-pin RS-232C. All connectors are female, 8 cables are extra.

2-Way Switch Box	\$109.88
4-Way Switch Box	\$CALL

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300G (12" green)	\$149.88
300A (12" amber)	\$159.88
310A (12" amber)	\$199.88

NEC

	
JB-1205M (12" amber)	\$189.88
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HX-12



The HX-12 is one of the finest RGBs available for the IBM PC. Features 16 colors, 31mm dot pitch (NEC's tube), 680 dots by 240 lines interfaced & 15MHz bandwidth. Comes with its own cable.

PGS also has the Max-12, an amber monitor with TTL input (IBM monochrome adapter input), 18MHz bandwidth & 720 x 350 lines.

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Password PC Modem PC Modem 256



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ROLAND DG

MB-121 MB-122

An exceptional monitor series that offers either an NTSC composite or TTL-type video output (compatible with the IBM PC monochrome adapter). The MB-120's feature 12" diagonal screen with a 90 degree angle & non-glare surface, 80 col x 25 line display, an 18MHz bandwidth, 640 dots horizontal by 200 lines vertical resolution and composite video (MB-121, RCA phono cable included) or TTL (MB-122, w/TTL-type DB-9 male cable). They come green (G) or amber (A).

Roland DG MB-121 (Green or Amber).....\$159.88

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The Password, an external device, comes with an RS-232C cable (specify male or female DB-25), power supply & modular telephone cable.

The PC Modems are plug-in modem boards that have all the features of the Password. The PC Modem 256 is also modem boards that come with 64 or 256K RAM, a parallel port & real time clock with a battery back-up.

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AST RESEARCH

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256K MegaPlus.....	\$509.88
Parallel Port.....	\$329.88
Optional #2 RS-232C Port.....	\$49.88
Game Port.....	\$49.88
256K MegaPak.....	\$329.88

SiPak Plus

The SiPak Plus has an RS-232C port, a parallel port, clock & memory to 384K. Software included. An optional game port is also available.

64K SiPak.....\$269.88

256K SiPak.....\$489.88

384K SiPak.....\$659.88

Game Port.....\$49.88

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Letters to PC

Warming up to dBASE II

I thoroughly enjoyed the practical suggestions Adam Green gave in "Food for Thought" concerning the environment conducive to learning in a classroom ("Advice From The Master On Learning dBASE II," PC, Volume 3 Number 2).

I wonder how I was able to stay awake during my college classes when the thermostats were set at either "on" or "off." The classrooms at Bucknell were hot—those were the days before the cost of oil shot up.

Where can our computer club obtain the Aquastar projector that Adam Green used to display the computer screen on the wall? We have been looking for something like this for some time. Possibly other user groups would appreciate your guidance.

Charles J. Wharton
Darien, Connecticut

Adam Green replies:

The Aquastar projector can be obtained by writing or calling the manufacturer at the following address:

ESP Systems, 1 Tico Rd., Titusville, FL 32780, (305) 269-6680.

Gone with the Wind

I read "The PC Analyzes The Wind" (PC, Volume 3 Number 1) with some interest but far more disappointment. At Meridian Corporation, our PC not only analyzes the wind (in our case from a Campbell Scientific CR-21 micrologger



and a data tape cassette) but also simulates any wind turbine in that wind resource. It then passes the resulting power performance to a cost model that generates six ways to measure cost benefit given a user load demand (with tables and graphs generated as a user option).

In a few minutes you can select the best wind turbine for your specific application and site or, conversely, describe the wind resource necessary to make an installation cost-effective for your specific application load demand.

We offer this service to anyone who mails a big payment check to his or her local utility on windy days.

Peter Borgo
Falls Church, Virginia

Dead End

You can lead a horse to water, but you can't make it drink! James Perotti feels that there is a "major flaw in PC-DOS 2.0" and that "... PC-DOS 2.0 makes it

impossible to access output files from another directory" ("Avoiding Dead-End Paths On The Hard Disk," PC, Volume 2 Number 7). PC-DOS 2.0 sends the segment address of the passed environment, of which the PATH command is a part, to the called program in the Program Segment Prefix (DOS manual, page E-4). If a software package is not written to take advantage of the path set in the environment, then I can't see laying the blame on PC-DOS 2.0.

Robert Brazeal
Huntsville, Alabama

Upon reading your December issue I found an inaccuracy in "Avoiding Dead-End Paths On The Hard Disk" by James Perotti. In a discussion of the use of the CHDIR command under PC-DOS 2.0, the sequence went something like this:

CD /SD

was used to change the current directory to the *SuperCalc* sub-directory.

CD /SD/CALC

was used to change the current directory to the *CALC* sub-directory under the *SuperCalc* sub-directory.

Now the command: CD /CALC was given as an equivalent to the previous command, namely CD /SC/CALC. This is not true. Instead, DOS 2.0 returns an "invalid directory" message indicating that it

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LETTERS

does not recognize anything other than fully qualified path names under such circumstances, even though you are currently in the SC subdirectory. This is a long recognized flaw in DOS 2.0. Let us all hope that the next version of DOS will correct this and other annoying bugs.

Dan D. Gutierrez
Woodland Hills, California

James Perotti's article "Avoiding Dead-End Paths On The Hard Disk" stated that few vendors have released revised programs that take advantage of the added capabilities of the tree-structured filing system of DOS 2.0.

I don't know how many vendors are in our situation, but my company would love to be able to take advantage of a number of DOS 2.0 features. Unfortunately, we can't. Our project management package, *MicroPERT* Ø, is written in compiled BASIC and the compiler has not been updated for DOS 2.0.

The software vendors in our situation aren't neglecting DOS 2.0; the vendor of the BASIC Compiler has neglected that product. Needless to say, we are waiting with bated breath for an update to the compiler or for an alternative.

Also, I'm not at all sure what Perotti meant when he said, "Even the revised BASIC supplied with the XT has no provision for accessing subdirectories." I was able to access files and programs in other directories and subdirectories from either BASIC or BASICA. The only problem I can see is that DOS won't recognize a command to load a program from other than the current directory.

Leland C. Sheppard
Redding, California

Another Unix?

In "Letters to PC" (Volume 3 Number 1), David M. Grabar expressed my feelings about the "drag-our-feet" attitude of the Big Two towards Unix. I have good news for Grabar, which he has probably already seen in the Unisource Corporation ad in the very same issue.

Unix for the IBM PC is here! It is real, licensed Unix. It works, and it works well. This Unix is basically Western Electric System III with some enhancements and was ported to the IBM PC by VenturCom. It is called Venix/86. I have had the opportunity to spend several days working with this operating system, and I can assure you that Venix/86 is really Unix, and it is amazingly fast.

Wheezing 8088? Not when it is given a "proper" operating environment. I had my doubts, but if you start using Venix and spin off a couple of FIND commands from the Berkeley *csh* and drop into the very adult screen editor *vi* and find no objectionable performance degradation, you immediately realize that the "new" generation has arrived. I noticed a few quirks in the hundred plus utilities that are available, but the best news is that I was unable to make the machine die using the *shell*, *vi*, or any of the common commands. I didn't try *nroff*, but my belief is that it won't run any faster than it does on a VAX! At least you will only have yourself (or maybe two other users if you get the multiuser version) to blame when the machine's back breaks under the load of *nroff*.

The bad news is that you cannot run Venix without at least 10 MB of hard disk—the faster, the better. You also need at least 256K of memory, and more memory translates directly to better performance, since there will be less swapping activity. Each process gets at least 64K of memory, more if loaded as separate I/D. Without memory arrangement, that is about the best you can do and still provide some measure of protection. And I didn't see a copy of *rogue*, so I guess I'll have to boot PC-DOS every 8 hours to keep from going into withdrawal.

Now, I want you guys from PC to put on your gumshoes and tell us when we'll get Unix System V!

Rick Richardson
Waltham, Massachusetts

Reviews of all the Unix implementations

on the PC are in the works, and initial evaluations are encouraging. We're still gluttons for power, though, and are embarking on a second series reviewing the add-in superchip boards with their implementations of Unix, Venix, and Coherent.

Meanwhile, it's good to know that Venix performs well for you. We'll see how it fares against the competition, including IBM's implementation.—Ed.

Fast as a PC

I would like to comment on your treatment of an issue brought out in "What A Difference A Millionth Can Make" ("PC News," PC, Volume 3 Number 1).

This item, devoted to divulging yet another numerical quirk of BASIC, ends with a plea: "Has anyone found a way to get BASIC arithmetic to come down to earth?" I am sure that anyone who has worked with BASIC has had similar difficulties and let out similar cries for help.

PC often falls a bit short of elucidating where the problems regarding numerical accuracy lie. For example, in your review of programming languages, a special spreadsheet was devoted to the speed and size of object modules ("A Guide To Language Performance," PC, Volume 2 Number 4). Nowhere in the article did you mention numerical accuracy, let alone include a benchmark that might point to differences in accuracy between the different languages. Interestingly enough, in the same issue you included an excerpt from the 8087 NDP book in which the author states that "... easily written, fast executing programs are no great trick—if you don't care about getting the right answers" ("8087: Applications And Programming").

The final straw is your review of *StatPac* ("Adding It Up With StatPac," PC, Volume 3 Number 1). The author gives numerous suggestions for improving the speed of the program, including RAM disks and spoolers. However, not one word is written on the numerical accuracy of this program. A review of this sort,



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LETTERS

while helpful, misses the central point of giving accurate analyses.

I'm not stating that speed is unimportant. But we should not be more impressed with a compiler that solves a problem in .2 seconds than we would be with one that might take 40 times as long—8 seconds—unless the faster one gives the right answer. In future reviews, I would like to see a better balance in your coverage of both speed and numeric accuracy.

Carlos Y. Maldonado
Yonkers, New York

PC Reads the Stars

We were pleased to have our *Superprogram II* horoscope-casting and our *Astro-Scope* horoscope-reading programs reviewed by someone who knows astrology as well as computers ("Casting A Horoscope With A PC," *PC*, Volume 2 Number 7). Although our software was for the most part reviewed favorably, we would like to comment on some inaccuracies.

Contrary to the impression given in the review, *Astro-Graphics Services/AGS Software* is not a recent entrant into the field. We were founded in late 1979 by Robert Hand, the first astrologer to write horoscope-calculation programs for microcomputers. AGS began selling astrological programs in 1980.

The reviewers of *Deluxe Astro-Scope* failed to note that the \$365 price includes a batch loader and a license to sell the copy-righted printed output. (Appropriately, this review appeared in an issue headlined "Making Your IBM Earn Its Keep") The price of our program designed to generate saleable printed horoscopes was compared with the much lower price of our competitor's screen-output program to instruct beginners. If comparisons were to be made, they should have been to our competitor's licensed text natal horoscopes, which costs three times as much as ours.

The review states that *Deluxe Astro-Scope* has no house options, whereas it has always had four: Placidus, Campanus, Koch, and Gergiomontanus. Its successors

(Monthly, Daily, Contact, and Composite Astro-Reports) all have adjustable aspect orbs as well as a choice of house systems, and this feature will soon be incorporated in the earlier program.

In regard to our advanced horoscope-calculation package, *Superprogram II*, at least one inaccuracy seems to have been made. The reviewers say that "printing hardcopy is not possible." All versions of *Superprogram II* output horoscope wheels, aspectarians, longitude listings, and all other information to the printer. A list of planetary and house positions also appears on the screen.

An entirely new program, tentatively titled *Superprogram III*, is being released in mid-1984. *Superprogram III* is being written to combine the accuracy and crisp output of *Superprogram II* with greater ease of use and many more options. In keeping with our policy of software support, *Superprogram II* users will be given a chance to upgrade to this greatly enhanced version for less than \$70.

Patricia White
Orleans, Massachusetts

Lost Memory?

What is the real reliability of the IBM PC? I've had my PC for just over a year and I'm just starting to utilize the unit. After working the PC for 4 or more hours I sometimes get a "Parity Check 1" reading and must reboot the system. The repair technician has been unable to correct this problem and my PC has been in the shop four times as of this date.

I believe this is not an isolated example because I know of four other PCs with the same problem. Maybe someone has an answer to this problem.

John Helle
Chesterfield, Missouri

Overall, the PC's reliability is quite good. Parity check errors can be caused by several things, though. The most likely culprit is a memory chip that is heat-sensitive and only marginally defective. Other possible contributors are static electricity or a

nearby source of strong radio frequency signals. A few old RAM disk programs were known to cause parity check 1s and 2s by incorrectly initializing memory.

Flaky memory has long been one of the computer industry's most difficult service problems. Try an old repairman's trick: Run your memory diagnostics repeatedly while using a hair dryer with a concentrating cone to raise the temperature of each chip individually. Other factors can cause parity checks, but they go beyond home diagnostics (and the abilities of most repairmen).—Ed.

Every Last Bit Counts

In the article "The XT/370: A Technical Overview" (*PC*, Volume 3 Number 1), Charles Daney pointed out that there were 12 bits in each Page Table Entry while only 10 were used (3 for status information and 7 for identifying the page number).

While it is probably true that these 2 extra bits will be used for allowing a larger memory, we should also be looking for a "segment table" to indicate the user of a particular group of pages in a multiuser system, or the "protection ring" of a file or program in a Unix-like protection scheme. This is very similar to how Multics', Unix', and even IBM's MUS all work.

Since it is highly likely that IBM will move to multiuser systems, I think we all ought to watch those 2 bits carefully!

Jerrold M. Grochow
Arlington, Virginia

America First

I've just finished reading your cover story in the December 1983 issue by Paul Somerson titled "There's No (Work) Place Like Home" (see *PC*, Volume 2 Number 7).

I would like to take issue with Mr. Somerson (sic) attitude of the American worker and labor unions. He his (sic) obviously anti both. The American worker is one of the most productive workers in the world. The workers and unions were,

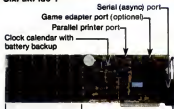
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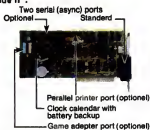
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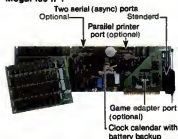


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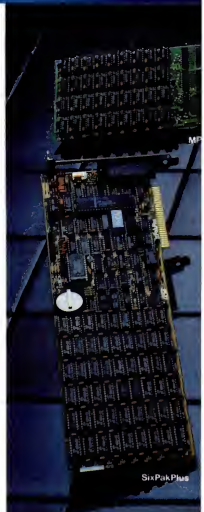


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in retrospect, greedy, in their wage demands, but in last couple of years they have given back to the companies a great deal. While they have been giving high ranking officers of these companies have been giving themselves large raises and at the same time announcing record losses.

Also don't forget unions were formed when the worker was being exploited by the owners, working for \$2 a day. I guess Mr. Somerson would rather go back to those days.

It's the American worker that probably built the PC (sic) that he uses to lambaste the American worker. It's because of the American worker at the office and factory producing a product that allows this pompous individual to sit at home and write articles.

Martin Oppenheimer
Santa Clara, California

Paul Somerson replies:

When they get a robot to replace you, I hope it can write a better letter.

Conversational Piece

Yesterday I picked up a friend's copy of PC to read your version of the news on the XT/370. Charles Daney's article ("The XT/370: A Technical Overview") was very informative. Among other things, I learned that CMS stands for Cambridge Monitor System. For years I had thought that CMS was an acronym for Conversational Monitor System. I looked in my CMS manual and sure enough, it said, "Cambridge Monitor System," published in Conversational, Massachusetts.

John Pierce
Corte Madera, California

That's How the Rock Crumbles

I have been working with micros for a while now, and I am getting a good sense of what they can do. As a matter of fact, I hadn't come across an applications problem I couldn't solve—until now. I'm in the middle of one that has me stumped.

I work for a company that sells crushed rock. I am trying to use an IBM PC to print

scale tickets, then interface it with an accounts receivable program that would print statements and age receivables. I have thought about writing a program to handle this task, but I suspect someone has already written one. I have found many nice accounts receivable programs, and I have an adequate scale operation program that runs on a Z-80 machine, but the two won't interface.

My hook is baited; I hope I've cast it into productive waters.

Ray Kelm
New Braunfels, Texas

Readers?—Ed.

For Dvorak Fans Only

Thanks for the excellent article, "Bye-Bye Qwerty," on the Dvorak keyboard in your January 24 issue (PC, Volume 3 Number 1). I have just one minor correction: Dvorak's patent, number 2,040,248, was issued in 1936 rather than in 1932, and was granted jointly to Professor Dvorak and one of his associates, William L. Dealey.

Also, a few additions for those interested in the more ergonomic Dvorak keyboard. There is a nonprofit quarterly newsletter for Dvorak aficionados, "Quick Strokes," available for \$10 a year from the Dvorak International Federation (DIF), Box 643, West Sacramento, CA 95691, (916) 372-7372. An outstanding tutorial for learning the Dvorak keyboard is "Smith-Corona's Short Course for the American Simplified Keyboard (ASK) Typewriter," available for \$5 postpaid (\$5.30 in CA) from DIF at the same address. Lastly, the American National Standards Institute, 1430 Broadway, New York, NY 10018, recently approved the Dvorak layout as an alternative keyboard arrangement for office machines, per its standard ANSI X4.22-1983.

David Pressman
San Francisco, California

User Group

I would like to bring a very serious matter

to your attention concerning one of the organizations listed in "PC User Groups." I believe that Personna Computer Association has flagrantly misrepresented itself, consistently failed to meet commitments, and taken my money. I am presently in the process of lodging a mail fraud complaint against the group.

I sent Personna \$45 over a year ago. They cashed my check but I never heard from them. The only thing I've gotten out of this is a very high phone bill resulting from the calls I have made to New Jersey trying to reach them.

I urge you to alert other readers to this problem with Personna.

Darrell W. Green
Burbank, California

All attempts to reach Personna to get a denial or confirmation of Green's complaints were futile. Although Personna's answering service assured us that our messages had been received, there was no response. PC will drop the Personna listing from our "Club News" department in future issues.—Ed.

Corrections:


Scott Pakin's name was inadvertently omitted from his "User-To-User" contribution ("Back From The Dead," PC, Volume 3 Number 3). Pakin is from Chicago, Illinois.

The correct price for the PC-300 Bar Code Reader is \$795 ("New On The Market," PC, Volume 3 Number 1).

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Software Buyer Beware

The consumer protection tenets applied to the rest of the world haven't penetrated the microcomputer software marketplace, but it's only a matter of time until they do. One way or another.

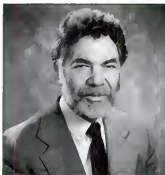
Caveat Emptor is the motto of the informed consumer. Most of us are aware of our rights in the conventional marketplace. But is the consumer protection movement relevant in the brave new world of microcomputers?

Just think back to the last piece of software you bought. Its advertising stated that you would get results unobtainable with any other program and that a manual was not really needed but that one was included anyway. Reviews stated that the program was a snap to use.

Welcome to the Real World

You made the purchase with great anticipation, but when you got home, the program wasn't all it was cracked up to be. The "unnecessary" documentation turned out to be necessary after all, and insufficient besides. In addition, the program was copy-protected so you had to boot it from a diskette each time you used it. Help was available from your dealer only if you bought an expensive service contract.

Many computer users have confronted similar situations. Yet you can't say you weren't warned. Most programs contain some sort of license agreement statement, which alerts the buyer that opening the package indicates acceptance of certain terms. For example, the program may be used with only one computer, and there are no assurances that the program will



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perform as advertised.

For comparison, look in the front of any book. It will contain a statement like this: "All rights reserved. No part of this book may be reproduced in any form without permission in writing from the publisher." Unlike a software license agreement, it doesn't warn or threaten. And bookstores allow you to browse.

Have you ever tried to browse in a computer store? I was once considering buying an operating system priced at around \$600. I went to a well-known computer store and asked to look at the documentation. I was told no, the store did not carry unsealed copies of software. I asked the salesman if he would buy a \$600 suit without trying it on. Of course, he said he

wouldn't. When I pointed out the similarity, he replied, "That's the way it is."

That is probably the way it will stay as long as consumers continue to accept these terms. I cannot think of another industry product that treats the consumer so abysmally. You can try on clothes and test-drive cars, but, as a rule, you can't even look at software documentation.

A few concessions are tossed your way. Some vendors allow you to purchase a demonstration disk or a copy of the documentation. But I don't remember ever paying for a test-drive or putting down a deposit to try on a suit.

Problems and Solutions

There is a glimmer of hope on the horizon. I have seen a few software advertisements that clearly state the level of user sophistication required to utilize the products. A few manufacturers will accept a return within 30 days. However, these enlightened vendors are still rare.

Professional consumer protection agencies have not yet taken a serious interest in the problem of truth and performance in microcomputer software. The industry would do well to undertake its own regulation before that happens. ■

Morton Kaplon teaches physics at City College of the City University of New York.

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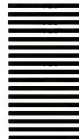
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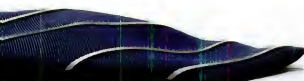
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CIRCLE 120 ON READER SERVICE CARD

The PATH to Your Command

Command search paths can save you and your DOS time and energy, if you know how to use them correctly. Here are some techniques to help you get more out of the PATH command.

In this column, we have been exploring some of the interesting ramifications of subdirectories on disks. Our goal is twofold: to obtain some technical insight into the working of subdirectories and to learn some practical techniques for using them.

Most of the practical insights we can get about subdirectories derive from two aspects: the current directories and the command search path. Here we'll look into the command search path.

When we give DOS a command, such as `FORMAT` or `CHKDSK`, it has to find the program that will carry out that command. Several of the most fundamental commands, such as `DIR` and `DATE`, are built into `COMMAND.COM`, DOS's command interpreter. These are called the internal commands. If the command that we've asked DOS to perform is internal, DOS's command interpreter has the program that's needed right at hand, so it looks no further.

Looking for Commands

When a command isn't internal, DOS has to go looking for it. This first place it looks is in the software cartridges that the PCjr uses—that's true not just for the PCjr's DOS 2.1, but for 2.0 as well. Of course, if we're working with an ordinary PC or XT, there aren't any cartridges. In any event, whether we're working with a



Peter Norton

PC or a PCjr, DOS makes a quick check to see if the command we've asked for is on a cartridge.

If DOS doesn't find a command in its internal table, or on a cartridge, then it looks on disk for a command file (a file with an extension of `COM`, `EXE`, or `BAT`) with the same name as the command we entered. Here is where DOS 2.x (level two versions) are different from DOS 1.x (level one versions).

In various 1.x versions, DOS only looked to the current drive to find command files. In the old days, that was the only place that DOS went looking for disk programs—on whatever diskette was loading in the current or default drive.

DOS 2.x still looks to the current disk

drive for the command file. One small difference is that DOS 2.x only looks for our command file in the current directory of that disk. DOS keeps track of a current directory for each disk drive, and that's usually where all the action is. The current directory can be just a disk's root directory—the normal, everyday directory that every disk has—or it can be any subdirectory on the disk.

This, however, is not the really interesting part. The wonderful thing about DOS 2.x is that it allows us to use the `PATH` command to tell DOS to look in several different places for a command file. The `PATH` command lets us instruct DOS to hunt for our command files in as many places on disk as we want. Without a `PATH` command, DOS just looks for commands where it has always looked, in the current directory of the current drive.

Strolling Down the PATH

Suppose we have an XT, or a PC with a fixed disk added, and the fixed disk is drive C, as it normally is. We might keep many programs, particularly DOS programs like `CHKDSK`, all in one directory. (I use the disk's root directory.) For discussion's sake, let's say that our programs are kept in a directory named `PROGS`; the full path name to `PROGS` would be `C:\PROGS`.

(continued)

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NORTON CHRONICLES

Ordinarily, if we are working in another directory, we wouldn't be able to get to our programs. But if we have entered a PATH command, we can tell DOS to look to our PROGS directory. It's done like this:

```
PATH C:\PROGS
```

Once we've entered that PATH command, DOS will keep track of it and look to the directory we've specified for command files. So if we've switched our current directory somewhere else, DOS will still be able to find and execute any programs in the PROGS directory.

This operation works even if we've switched the current drive. For example, with an XT or other hard disk system, we usually keep the hard disk as the current drive. But if we want to work with a diskette for the moment, we'll temporarily switch our current drive to the A: drive. With the PATH command shown above, DOS will still be able to find and use all the programs in our PROGS directory.

To make sure that the PATH command works right for you, it's important to specify carefully the full pathname of the directory, including its drive letter. Suppose we'd left this part off in the previous example, so that the PATH was just \PROGS. When we switched our current drive to A, or any other drive, DOS would search for a PROGS directory on that drive, since the PATH command didn't specify which drive to look at.

There's even more power to the PATH command. We aren't limited to telling DOS to search a single directory path—we can give lots of paths in the PATH command. To do this, we just list all the directory paths we want DOS to search, separated by semicolons. Here's a command that will look for programs in two directories:

```
PATH C:\PROGS;C:\OTHERS
```

After we enter that command, DOS will go looking for commands in both directories, in the order we gave them. In this example, DOS will search the PROGS file

before it searches OTHERS. As soon as it finds the command program we've asked for, it will run it.

We can put lots of paths in the search if we want to. Although I don't think that it's a good idea to scatter programs through a bunch of directories, if your programs are scattered you can still use them all conveniently by setting up a PATH command that tells DOS to look through all of them.

It's important to specify carefully the full pathname of the directory.

Another wrinkle in the use of multiple paths is that the paths we tell DOS to search can be on different drives. This turns out to be one of the best and handiest uses of the PATH command.

While we might not have our programs spread out in several subdirectories, we might have them in several different drives. There are lots of good reasons for doing this. For example, if you're using a RAM disk (memory set aside to act as an ultra-high-speed disk drive), you could load your most frequently used programs into the RAM disk and use the PATH command to have DOS try to find programs there first. Suppose your RAM drive is drive D and you usually use a diskette in drive A for any programs that aren't loaded into the RAM drive. Here is the PATH command that you'd want to use:

Checking Other Drives

```
PATH D:\;A:\
```

With that PATH, DOS will check the RAM drive, D, first, and then the A: drive. It all happens automatically, so you don't have to worry about where your programs are.

Some of us may have loaded up our systems with lots of disk drives. One reason for doing this is to have more programs on tap without the expense of buying a hard disk. For example, I have friends who have four floppy disk drives. They use the A: and B: drives as most of us do, swapping diskettes in and out as needed. But they keep the C: and D: drives loaded with the same diskettes all the time; these diskettes hold the programs that they run most often and need to have on tap constantly.

The PATH command can make it easier to work with such a setup. We just enter a PATH command like this:

```
PATH C:\;D:\;A:\
```

DOS will automatically search through the D: drive, the C: drive, and then back to the A: drive. Wherever a program is hiding, DOS will find it.

Before DOS searches through any directories that we've asked it to search with the PATH command, it searches through the current directory in the current drive. This has two practical results. First, there's no need to put our current directory into the search path. DOS will look at the current directory anyway; putting it into the path will just make DOS search there twice and slow things down. Second, since the current directory is searched first, we can't use the PATH command to override any programs in the current directory. If you have a program in the current directory, but you want to use another version of it in another directory you'll have to give it another name, because DOS will use the copy of the program in the current directory before it looks elsewhere.

These examples of how the PATH command can be used—with programs in different subdirectories, with programs in a RAM disk, and with programs scattered through several diskettes—should give you enough clues to adapt these ideas to your own particular working style.

In the next column, the last in this sub-directory series, I'll give you some practical tips on organizing your directories and getting the most out of the PATH command.

Putting PC Compatibles To the Test

PC Magazine takes a first look at some of the new entries in the PC-compatibility sweepstakes. How well do these new machines fulfill the varying claims made by their manufacturers?

Since the advent of the IBM PC and the subsequent onslaught of PC software, it has become obvious to many merchants in the microcomputer marketplace that their customers are looking for machines that can run programs designed for the IBM Personal Computer. As a result, during the last few months approximately 30 microcomputer manufacturers have announced that they are producing PC-compatible computers.

What does the term *PC compatible* mean? Will these machines run the complete gamut of PC-DOS software, a percentage of PC-DOS software—or simply run MS-DOS alone? The definition of compatible seems to vary according to which advertisement you read or which manufacturer you talk to.

To help consumers find their way through the growing forest of PC-compatible computers, we decided to take a closer look at as many of the recently released

PC-compatible machines as we could. Once we had a fair representation of these micros assembled in our offices, we brought in our top technical writers to check out the validity of the manufacturers' compatibility claims and to evaluate overall performance.

To judge the machines fairly, we divided them into several categories. We separated portables from desk-top models, floppy disks from hard disk drives, machines by established manufacturers from those produced by relatively new companies, and machines that have already hit the market from those still in the early production stages.

Our writers then ran a variety of PC software on each machine. These included the IBM PC diagnostics test, and disks written and formatted on a PC using DOS 2.1, BASIC, *WordStar*, *1-2-3*, and *dBASE II*. They also clocked each computer's speed in finding prime numbers

with a *BASICA* program and looked over their expansion slots and keyboards.

However, this evaluation is different from the usual microcomputer review that runs in the pages of *PC*. We have not undertaken a full investigation of each machine's capabilities. In fact, many of these computers will probably be the subject of more comprehensive *PC* reviews in the future. Here, we have tried to judge these compatibles as the innovations that they are: microcomputers that have been designed not only to run their own software, but also to run the software of another major product.

This exercise is also an indirect assessment of the IBM PC itself. One reason for the PC's popularity is the large variety of software available for it. If another manufacturer can produce a machine that not only runs most or all of that software, but can run it faster or less expensively, then IBM will have to pay close attention. ■





How Blue Can You Get?

Does anyone really know what "PC-compatible" means? Here are some guidelines to help you wade through the ever-enlarging sea of computers that call themselves compatibles.

The phrase, "For the IBM PC and its compatibles," often crops up in computer advertisements. But what is *compatible*? There are many definitions, most of them created by vendors who wish to portray their products as similar to the IBM PC.

Since the term *compatibility*, as applied to computers and computer-related products, is not universally defined and is used loosely by manufacturers and writers, how are we to distinguish between computer *x* and computer *y* when both claim to be "PC-compatible?" The only way to deal with the problem is to develop an understanding of the various levels of compatibility in the computer world.

Setting Guidelines

When a computer is described as "compatible" with another machine, it

may fall into any one of the following categories:

- **functionally compatible.** This lowest level of compatibility indicates that various programs and operating systems run in the same manner on various machines. I can run *dBASE II* on my IBM PC, Apple II+, TRS-80 Model II and Osborne I by using the same commands and operating procedures. I cannot, however, put my Apple *dBASE II* program and data diskettes into your IBM PC and work with them, because the disk format, operating system, and internal processing chips are quite different. The diskettes used by two different computers might even be different sizes.
- **data compatible.** This next level of compatibility allows data disks to be read from one machine to another. It has been announced that the recently released Tan-

dy TRS-80 Model 2000 will be able to read data produced on an IBM PC under the MS-DOS operating system (see compatibility test in this issue). You should be able to read data created under the IBM version of *MultiPlan* into the Model 2000 version of *MultiPlan*, but you still must own and maintain two sets of *MultiPlan*—an IBM version and a Tandy 2000 version—to run both systems.

- **fully compatible.** This highest level of compatibility results when manufacturers strive to develop machines that are intrinsically close enough to the target computer that they can run programs developed for the other computer without modification. It is this final level of compatibility with the PC that most of the computers reviewed in this issue attempt.

Perfect intrinsic compatibility with the IBM PC is impossible to achieve because

IBM uses a proprietary method of loading Microsoft BASIC. The PC contains the "kernel" of BASIC on a ROM chip on the computer system board. Enhancements to this kernel, called BASIC.COM and BASICA.COM, are contained on PC-DOS diskettes. When you wish to run a BASIC program—in this example, MYPRG.BAS (the .BAS suffix indicates to the system that it is a BASIC program)—you type BASICA MYPRG. The system responds to this input by loading BASICA from the diskette. This load procedure, unique to the IBM PC, recognizes the existence of the BASIC kernel in ROM and loads the disk-based extension as a supplement to the ROM-resident kernel. The computer then loads your BASIC Program, MYPRG, and executes it.

The loading and execution of a BASIC program in a PC-compatible computer differs in that the BASIC interpreter loaded from the diskette is the full implementation of BASIC and not an extension. On the Compaq, for example, the full BASIC on diskette is called BASICA, so no change in procedure is required when loading programs. On some other machines, such as the Corona, the full BASIC on diskette is named GWBASIC. While this BASIC, also from Microsoft, is equivalent to BASICA, the difference in names causes some difficulty with programs that run automatically on system startup. These programs are invoked by AUTOEXEC.BAT files that contain the entry BASICA MYPRG within the file. When you use a system that comes with GWBASIC, you must use a text editor to change those commands to GWBASIC MYPRG.

The Price You Pay

Manufacturers who attempt to attain full compatibility pay a price: They com-

mit themselves to emulating not only the virtues of the PC but also its deficiencies. While Compaq and Columbia have chosen the path of total compatibility, others have not. Hyperion has not emulated all the deficiencies of the IBM keyboard and is marketing a keyboard with the Shift key in the right place and the function keys on top. Tandy has chosen a faster chip for its TRS-80 Model 2000. In the first case, the change is essentially cosmetic; in the sec-

In a PC-compatible computer, the BASIC interpreter loaded from the diskette is the full implementation of BASIC.

ond it is not. The Tandy machine can't run all of the available software for the PC. It must instead count on convincing software producers that the market for Model 2000 programs is significant enough to warrant marketing new software in a format that it can use. Hyperion's decision to offer an improved keyboard was not a decision of the same magnitude and does not have as profound an effect.

Manufacturers who attempt to achieve full compatibility are choosing by far the safest route. Although such manufacturers appear to be merely sacrificing performance, there are broader implications. While we might prefer the layout of the Hyperion keyboard and would choose that design if it were our only computer, we certainly wouldn't want the third, fourth, and fifth computers in our office to have different layouts from the first two com-

puters, which are IBMs. We want all our systems to be completely interchangeable. Those who strive for total compatibility are attempting to sell to existing PC users, while others, like Hyperion, seem to be marketing their products as alternatives to the PC for the initial user. This observation is borne out by the fact that Compaqs are sold primarily by dealers that are also IBM dealers, such as ComputerLand and Sears, while other compatibles are primarily sold by non-IBM dealers.

Each compatible manufacturer must attempt to attain compatibility with the IBM PC yet include some features or qualities that differentiate its product from the PC. Otherwise it makes no sense for a purchaser to consider any computer but a genuine IBM. The various manufacturers have approached this issue in different ways.

Compaq has stressed convenience and portability while maintaining its commitment to total compatibility. Columbia Data Products has provided more expansion capability than the PC by including more expansion slots and built-in connections. Seequa has made its Chameleon compatible with the PC and with 8-bit CP/M machines, too. This computer includes two chips, an Intel 8088 and a Zilog Z80A. Bytec's Hyperion has improved features such as the well-laid-out keyboard and a new method of booting DOS. In addition, various manufacturers have "bundled" applications software with their machines, and most price their products lower than a comparable IBM PC configuration.

In the articles and reviews that follow, you'll see how in building their machines manufacturers defined the term *compatibility*, and how the resulting computers differ from one another and from the PC in both predictable and unusual ways. ■



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OPERATING SYSTEM	KEYBOARD
MS DOS Version 1.25 or 2.0 with G.W. BASIC	M4 keys, 6 ft. cord
MICRO PROCESSOR	AUXILIARY MEMORY
High-Speed 16-bit 8086	Up to two internal 5 1/4" diskettes
DISPLAY SCREENS	10MB external fixed disk when configured with single diskette
High Definition monochrome display	USER MEMORY
IBM compatible graphics	Standard 128K bytes, expandable to 640K
COMMUNICATIONS	DIAGNOSTICS
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The Sperry PC.
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should have been in the first place.

Playing Hardball Against the XT

Computer manufacturers knock heads with the \$40-billion giant and challenge the PC-XT. How well does each one succeed as it reaches for the magic words, IBM compatibility?

When you decide to bash heads with someone, it's a good idea to make sure your opponent's head isn't harder than your own. If you're in the computer business, you ought to know that the hardest head of all belongs to a \$40-billion giant, IBM.

Because of its tremendous marketing advantages, this giant can be as hard-headed as it wants. Not only does the company spell its name with three magic letters, but its computers have the ability to run thousands of applications programs with complete assurance of success. The IBM Personal Computer has become the one undeniable standard in the industry.

To succeed in head-to-head competition with IBM, a computer company needs an edge. For many, this means a lower price tag. But that strategy works only at the grace of the giant; at any time, IBM could flex a muscle called the "economies of scale" and, with a modest sacrifice of profits, undercut the prices of whatever corporate kamikaze challenged it.



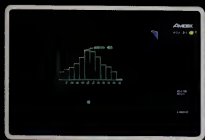
A better strategy is to seek out a market niche too small for the giant to worry about. As a side benefit, the price competition in these areas is not nearly so cut-throat, and even equally matched peers have a chance of survival.

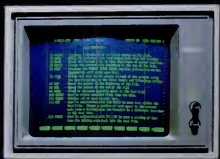
One of the best market niches is the high end: the personal computers that come with hard-disk drives. These machines prey not on the PC but on its big brother, the PC-XT.

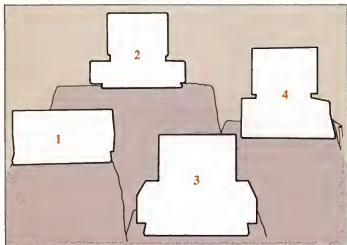
High Profits in the High End

The high end is a choice marketing area because it can be profitable. How much more does it cost to build a computer with a hard-disk drive instead of a floppy? If you buy your Winchesters in quantities of 100,000, you don't pay anything near \$2,000 for one, which is the premium price the market will pay for a computer with a built-in hard-disk drive. The difference is all cream.

The four machines examined here, the Compaq Plus, the Eagle 1600, the Stearns PC, and the Eagle Spirit XL, all try to butt their way into this profitable market. Two of them attempt to outdo IBM by using more powerful microprocessors. The other two are portables, which move the competition from the office to the field.







1 Compaq Plus
2 Columbia MPC 1600-4

3 Stearns PC
4 Eagle 1600

All four of these computers reach for the magic words that seem to guarantee success: IBM compatibility. This standard ensures access to a vast number of programs and hardware. However, true compatibility is unobtainable; it is guaranteed only by copying the ROM chips inside the PC, which IBM does not permit.

Here's a look at how each of the compatibles stacked up.

Compaq Plus

Compaq computers are designed to be the personal computers of the jet set; they are machines for wheelers and dealers who are constantly on the move. Compaqs try to put the best of both worlds—IBM compatibility and the portability pioneered by Osborne—into one package. The Compaq Plus adds the IBM PC-XT's

hard-disk power to Compaq's proven portable-and-compatible package.

In essence, the Compaq Plus repackages every nonproprietary part of the IBM PC-XT. The only major differences you'll notice are the monitor, which has been made smaller to squeeze into the package, and the ROM chips, which have been specially designed to squeeze between the lines of the copyright laws.

The Compaq Plus is so compatible that a disk from your PC-XT will probably run without a hitch, providing you insert it properly in the sideways-mounted floppy-disk drive. Our two test programs, *WordStar* and *dBASE II*, immediately felt right at home. Even IBM's DOS 2.1 ran smoothly. Also, disks formatted or written on the Compaq Plus ran fine on a standard IBM PC.

About the only exception is BASIC. Part of IBM's version of the language resides in the solid-state ROM, and part of it is on disk. However, the Compaq Plus keeps all of its BASIC on disk. The language programs for the two machines differ enough that IBM's BASIC did not run on the Compaq Plus. The moral is to use

each version of BASIC only in the machine for which it was intended. However, Advanced BASIC is loaded the same way on both computers.

Once BASIC is running, the programs that use it are identical and interchangeable, because both machines speak the same dialect. And both think at roughly the same speed. Our test program, which confirms that the prime numbers under 50 are actually prime, ran in 1 minute and 19 seconds on the Compaq Plus—roughly the same time as on a PC.

We checked the time required to load *WordStar* and noted that starting from a floppy disk took 3 seconds to get to the first screen and just over 6 seconds to finish painting the no-file menu across the monitor. The time to get the program off hard disk was well under 1 second. Both timings are equal to those of an XT.

We tried a pair of special compiled-BASIC disk-drive speed tests: One repeatedly writes a file, the other repeatedly reads one. The Compaq's floppy-disk drive took 1 minute and 19 seconds to perform 10 reads of 20 1024-byte records (the standard test). The same number of write operations took 2 minutes and 34 seconds. The same tests on the hard-disk drive took 15 seconds for reading and 21 seconds for writing. These results are roughly equivalent to those expected from an XT.

Diagnosing the Problem

Running the diagnostics disk from a cold start resulted in some problems. The program correctly determined the amount of memory and the number of attached drives, but progressing further resulted in a number of errors—first an Error, System Unit 101, and then a Parity Check 1 message. When the first one occurred, the diagnostics went so far as to try to check the keyboard, but refused to recognize anything I typed—including the Ctrl-Alt-Del warm boot.

Trying to run the diagnostics without turning the computer off and back on again was even more adventurous. Typing *DIAGS* on an XT will cause the system to

Compaq Plus

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20333 FM 149
Houston, TX 77070
(713) 370-7040
List Price: \$4,995

CIRCLE 730 ON READER SERVICE CARD

start to load and then hang—with the disk roaring away and nothing happening. But when the power is switched off and back on, the computer returns to reality. As I expected, in response to the **DIAGS** command, the Compaq Plus marched off to never-never land, and it didn't want to come back. Turning the machine off and back on again would not bring it back to life. Getting the machine running again required prying off the lid and reseating the circuit boards.

Pop off the plastic lid of the Compaq Plus and you'll find a furnace maker's paradise of sheet metal parts making up a solid but lightweight cage-chassis. The circuit boards are very similar to IBM PC expansion cards, but they are wider to accommodate more components.

Although it is possible to plug the standard IBM expansion cards into the Compaq, don't expect good results. Many suppliers claim that their enhancement boards designed for PCs will function well inside a Compaq. Complete expansion card compatibility, however, may be undermined by software that is too closely linked to the actual machine it was designed for.

Overall, the Compaq Plus proved to be somewhat irksome. The floppy-disk drive loved whatever IBM programs I shoved into it. It loved them so much it didn't want to let some of them out; they kept getting caught on the drive's read/write heads. I had to carefully bend the disks to dislodge and extricate them.

Furthermore, while Compaq has done a commendable job of reducing the weight of its machine, the lighter version has a disadvantage for a typist like me, who prefers to rest the keyboard on his lap and his feet on the desk. With the Compaq, this doesn't work; its cord is short and so tightly coiled it seems to be spring-loaded. When the keyboard slipped from my grasp, it leapt at the machine. When I tugged it back, the computer came with it, moving close to the edge of the desk.

Like the original Compaq, the hard-disk based machine proves to be one of the



Columbia's MPC 1600-4 is fully configured, but has six slots available.



In the Stearns microcomputer, only one socket is really PC compatible.



The Eagle 1600 contains eight slots arranged horizontally for compactness.

The interior of the Compaq Plus and the Eagle Spirit XL are not shown because, like most portable computers, hard disk or not, they are protected by anti-shock devices.

most compatible of the compatibles. As with most so-called portables, its compatibility with your arms and back is still less than optimum; nonetheless, the Compaq Plus is no flyweight.

Eagle 1600

The Eagle 1600 is for those who favor performance over IBM compatibility. Its resemblance to a PC is superficial; it's a box with two disk drives inside, a monitor on top, and a keyboard tethered by a coiled cord. Even on the surface, however, you can see that there's something different about this machine. Although, like the XT, it has both a hard-disk and floppy-disk drive, the positions of the drives are reversed, both physically and electronically. The full-height hard disk is to the left of the half-height floppy in our test unit, and the Eagle 1600 calls the hard-disk drive A. As a consequence, the Eagle 1600 automatically boots up on the hard disk. Unlike the XT, it doesn't waste even a moment to see if a floppy is in place.

The philosophy behind the Eagle 1600 appears to have been to better the PC wherever possible. For instance, a PC gives you 10 function keys, one for each finger. The Eagle 1600 lets you put your toes, nose, ears, and what-have-you into action with a grand total of 24 function keys. The 1600's keyboard will be a new world to you no matter what you're used to using. The function keys have been relocated in places you'd least expect them.

Even the floppy-disk drive is better than the PC's. We IBMers considered ourselves lucky when drives became double-sided and DOS 2.0 expanded its capacity from a paltry 160K to a reasonable 360K bytes per disk. The Eagle 1600 does better than that; it can stuff 803,840 bytes on an ordinary 5¼-inch floppy disk. The added capacity is achieved by shoe-horning in more tracks, 96 of them per inch, a scheme that's called "quad-density."

You Gotta Be Kidding

Just for laughs, I formatted an Eagle

XT COMPATIBLES

1600 disk (which takes 1 minute and 35 seconds, including the time to transfer the Eagle's operating system), filled it with files, and eased it into an IBM disk drive. As you would expect, the PC said its equivalent of "you gotta be kidding" and asked to see more suitable media.

The 1600, however, is a bit more enlightened. It was able to open up and display files on IBM PC-formatted disks.

But the big test was what the machine could do with the instructions packed into a program file. For this round of standardized compatibility testing, we used our two BASIC programs that write and read multiple files to disk. Both programs were compiled on an IBM PC using IBM's BASIC compiler. They ran without a hitch on a PC with 64K of memory.

The Eagle 1600, however, had other ideas. When I tried to run the read test from the Eagle 1600's floppy-disk drive, I was informed that the program was too big to run. The write test produced the error message: Disk Full at Address 06C0:00CB.

Not willing to be thwarted by insufficient disk space, I copied both programs onto the Eagle 1600's hard disk. Copying did not make the read test any smaller—I still got the same error message as before—but the increase in room given by the hard disk let the write test take off. The 1600 dashed through it in 15 seconds—not quite record time, but a good run.

Whether DOS 2.1 runs on the Eagle 1600 may forever remain a mystery. Because the machine boots from the hard disk, my floppy-bound boot program did me no good, and I wasn't about to send 10

megabytes of data to oblivion just to figure out how to get the necessary files onto the 1600's Winchester. The PC versions of *WordStar* or *dBASE II*, written on PC disks, did not run on the 1600. But the 1600 comes with its own *WordStar* (version 3.3) on its built-in Winchester, which loaded and ran in a blazingly fast, Winchester style, time of under 1 second.

As expected, the Eagle 1600 wanted nothing to do with IBM PC diagnostics. Because the hard disk is in the A position, I couldn't make the machine cold boot



with them, and trying to start them otherwise—say, by typing *DIAGS*—is guaranteed to send any machine into the twilight zone.

The interior of the Eagle 1600 is unique, yet it still retains some IBM PC-XT flavor. Like the XT, it has eight expansion slots. And, also like the XT, two of them are limited to cards of less than full length. Blocking the way is an angle bracket that seems to serve no purpose other than thwarting your use of longer cards. Although IBM-sized expansion cards might fit into these slots, I have not seen a peripheral manufacturer that recommended its products for this purpose.

The 1600 even offers a few advanced styling features. It encloses all the unsightly jacks and sockets inside a hidden area.

Essentially, the Eagle 1600 is a no-

compromise, high-performance personal computer that makes only a mild concession to the existence of IBM. Its PC-compatibility is, for the most part, limited to reading files from and writing files to disks that have been previously formatted in an IBM computer.

Stearns PC

The Stearns PC looks like an IBM PC on stilts; it has a pair of slim disk drives (one floppy, one Winchester) in the expected place, a monitor on top, and a tunnel underneath. The space between its short legs, which is about 2 inches high, is designed to serve as a doghouse for the keyboard—a place to tuck it safely away when not in use.

The keyboard itself is different enough from that of the PC that those accustomed to the IBM machine will need some reorientation. It's quieter, and, although it uses the standard QWERTY layout, its keys are more intelligently arranged than those on the PC. In addition to the usual function keys, it has four extra push-on, push-off keys on the upper right-hand side. However, as yet, those keys are unused by programs supplied by Stearns. The keys in the infamous reset combination, Ctrl-Alt-Del, are grouped closely together, between the alphabetic and the numeric/cursor keypads. While a one-hand warm boot is possible, the key arrangement prevents accidental resets.

For familiarity's sake, a duplicate Ctrl key is near to its IBM-ordained position. The Break key, however, is not only in an unusual position, but it is not labeled at all. The Stearns PC does have a built-in ability to program any key to elicit a string up to 256 characters long. Red LEDs indicate the status of the keys that toggle on and off (such as CapsLock).

The Stearns PC can use either of two monitors, both are monochrome and have moderately high resolution. One, which resembles many of the TV-like popular personal computer monitors displays 80 columns and 25 rows of crisp characters. The other, a 15-inch tube turned sideways,

Eagle 1600

Eagle Computer, Inc.
983 University Ave.
Los Gatos, CA 94035
(408) 395-5005

List Price: 10-MB hard-disk drive and floppy-disk drive, \$6,995; with 32-MB hard-disk drive and floppy-disk drive, \$8,995.

CIRCLE 729 ON READER SERVICE CARD

will display 55 lines at 80 columns wide, about a full page of text. Alas, the sideways tube comes equipped with a warning that the 55-line mode is not completely supported.

Inside the case are five expansion slots, one of which is physically identical to the IBM standard. The other four are for Stearns cards, which are the same size as IBM cards but have a different connector.

There's a good reason for the difference in expansion cards. Stearns cards use more pins on their connectors because the Stearns PC system is based on a 16-bit data bus (compared to the PC's 8-bit bus).

This difference accounts for the true magic that separates the Stearns PC from mere compatibles. Instead of using IBM's 8088 microprocessor, the Stearns PC uses the full 16-bit 8086. The performance of the Stearns PC reflects its 16-bit capabilities. It whizzed through the prime number test BASIC program in a mere 32 seconds, roughly three times faster than an IBM PC or XT.

To our amazement, the high speed presented no major problems programs in handling *WordStar* and *dBASE II* directly from disks written for IBM computers. In fact, the Stearns PC rivals the Compaq in IBM PC program compatibility.

The Stearns machine comes with its own operating system, ST-DOS 1.25, which is equivalent to a generic MS-DOS. When I tried booting PC-DOS 2.1, much to my surprise, both computer and operating system came to life nearly instantly. The only problem I encountered was that using DOS 2.1 gave no access to the Stearns PC's hard-disk drive. But when I

copied the Stearns ST-DOS-equivalent of a CONFIG.SYS file (and the three peripheral driver programs that went with it) onto my DOS 2.1 disk, all the parts of the Stearns PC performed perfectly. I was able to make, change and delete directories on both hard and floppy disk and move everything around without a hitch. The IBM PC was able to read disks formatted and written on the Stearns and vice versa. The formatting procedure took 48 seconds without system transfer and 55 seconds with it.



The only real compatibility problem I had was with BASIC. The MBASIC included with the Stearns PC is different from IBM's version of the chosen tongue, and consequently the prime-number checking program would not run. But when I slipped in BASIC borrowed from the Compaq Plus, both the language and the test program ran fine.

IBM diagnostics, however, wouldn't even load. I got the error message: Floppy Disk 08 I every time I tried.

The Stearns PC will happily run either *WordStar* or *dBASE II*, and its speed is truly like lightning. In fact, off-disk loading of this version of *WordStar* was deliberately slowed down so users would catch at least a glance at the copyright warnings. This version takes about 3.5 seconds to get to the first screen, while regular IBM PC *WordStar*, which ran perfectly, took less than a second. A standard IBM PC-XT

loads *WordStar* in roughly the same amount of time. This uniformity in disk-access times, both hard and floppy, points out that the disk data-transfer rate is the major speed limit on high-speed 16-bit microcomputers like the Stearns PC. This rate is fixed by the disk-drive controller rather than by the computer itself.

Of the computers tested, the Stearns PC gave the best combination of Supercharged 16-bit performance and PC compatibility.

Eagle Spirit XL

The only similarity between the Eagle Spirit XL and the Eagle 1600 is in their names. While the 1600 packs in a processor more powerful than the PC's, the Spirit XL is content with equality. Where the 1600 pushes disk capacity to the limit, the Spirit XL uses standard double-density disks. In fact, the Spirit XL can't handle the quad-density disks made by the elder Eagle. When I tried, the Spirit XL would read only the directory. It couldn't find a file (not even those it listed in the directory), and instead posted a File Not Found error message and steadfastly refused to do anything.

The Eagle Spirit XL puts IBM PC-XT performance in an almost movable package. Like most so-called "portables," *transportable* is a better description.

The Spirit XL offers a handful of minor improvements over the PC and XT. The keyboard is labeled with English words, such as TAB instead of IBM's favored arrows. Indicator LEDs glow bright red to remind you when you've toggled the CapsLock or NumLock keys.

Nevertheless, some classic IBM gripes—such as the skinny Enter key and the misplaced Shift key—remain on this

Eagle Spirit XL

Eagle Computer, Inc.
983 University Ave.
Los Gatos, CA 94035
(408) 395-5005
List Price: \$4,795

CIRCLE 727 ON READER SERVICE CARD

Stearns PC

Stearns Computer Systems Corporation
10901 Bren Rd. East, Box 9384
Minneapolis, MN 55440
(612) 936-2000

List Price: one floppy-disk drive and one 10-MB hard-disk drive, \$4,995; with one floppy-disk drive and one 20-MB hard-disk drive, \$5,995.

CIRCLE 728 ON READER SERVICE CARD

XT COMPATIBLES

PC-compatible machine. The keyboard layout is identical to the PC's.

The keyboard is light in weight and is tethered by a cord that lets you stray about 4 feet. That's about as far as you'd want to get from the tiny monitor, anyhow.

That monitor is one part of the Spirit XL where refinement over the IBM PC-XT is notably absent. The Spirit XL displays the IBM color character set on its monochrome face, substituting graphics abilities for genuine readability.

To the right of the monitor are the Spirit XL's two half-height disk drives, mounted sideways. Unlike the Eagle 1600, the floppy drive operates as unit A, and the hard disk is drive B.

The electronics inside the Spirit XL preserve enough of the workings of an IBM PC so that IBM programs have a reasonable chance of running—*WordStar* and *dBASE II* at least—at comparable speeds. Although the Spirit XL has the same problem with IBM's ROM-based BASIC as all compatibles do, once the BASIC supplied with the Spirit XL is running, programs written on an IBM PC will run on the Eagle machine. The standard BASIC prime-number test program put the Spirit to work for 1 minute and 28 seconds, which puts it in the same league as a genuine PC or XT.

Unlike its big brother Eagle 1600, the Spirit XL was happy to send its disk drives scurrying in response to the standardized IBM PC-compiled BASIC test programs. Floppy-disk performance was slightly slower than would be expected from a genuine PC (but not significantly so). The read test took 1 minute and 30 seconds; the write test took 2 minutes and 42 seconds. When using hard disks, the Spirit XL actu-

ally has a slight edge over IBM with a read test time of 10 seconds and a write test time of 17 seconds.

The Spirit XL happily accepted my DOS 2.1 disk. Using it instead of the standard Eagle operating system did not dramatically alter the Spirit XL's performance. Nor did it cause a problem.

Inside the Spirit XL are four PC-sized expansion slots. In the unit I tested, three of them were filled by expansion cards that were larger than the usual IBM PC expansion cards, much like the cards inside the Compaq Plus. Like the Eagle 1600, the Spirit XL's various sockets and connectors are protected behind a door in a small antechamber.

About the only thing that you can do with the Spirit XL that you can't do with an IBM XT is pick it up with one hand. More importantly, there's very little that an XT can do that the Spirit XL can't do—and that's probably its greatest strength.

Columbia MPC 1600-4

Columbia Data Products was one of the first PC-compatible manufacturers. Since we tested its original floppy disk MPC (see "Columbia: Call It A Work-Alike," *PC*, Volume 2 Number 1), the product line has grown, with hard disks and other enhancements. We brought the top-of-the-line 1600-4 machine with 10 megabytes of hard disk into the test.

Cosmetically, the Columbia MPC 1600-4 looks a little sharper than the model tested in our first go-round. The quality of the finish is better, and parts inside the case that were once bolted together are now heliarc-welded, well-finished, and professional. The 8-slot system board is essentially unchanged, providing two serial ports, a parallel port, and the floppy-disk controller. The result is a nearly empty chassis, with only the video controller board taking up a slot. The motherboard permits a maximum of 256K. You still have to do a major disassembly to add RAM or an 8087, but such occasions are so infrequent that it isn't really a problem.

You wonder, given the seven empty

slots, where the hard-disk controller is. Columbia chose to implement a couple of extra parallel ports on the motherboard and run a ribbon cable up to a large controller board that sits above the hard disk and floppy drives. The controller is actually a Z80-based single board computer with its own 64K of memory, but it's been programmed to exactly emulate the IBM disk controller.

So complete is this emulation that we were able to take a copy of PC-DOS 2.1 and do a front-to-back installation of DOS onto the hard disk. We wondered what sort of schizophrenia our brain transplant would touch off, but the Columbia was firmly convinced that it was a PC-XT and did not stray from that illusion during the course of our testing.

The Columbia executed our read and write tests in 1 minute, 20 seconds and 2 minutes, 35 seconds, respectively, on floppy disk, and cranked out a very respectable 9 seconds and 28 seconds respectively, on the hard disk. Columbia's historic expertise in 8-bit systems was obviously working for it when it designed the disk controller.

Naturally, the machine ran *WordStar* and *Lotus 1-2-3* without a hitch. *WordStar* loaded in 5.6 seconds from the floppy disk and in 1 second flat from the hard disk.

Overall, the Columbia is a solid machine, a fitting alternative to a PC-XT, with excellent disk access speeds coupled with the compatibility ensured by its use of the same chip set as the PC.

How the New Chips Stack Up

Do these four machines achieve their goal of IBM compatibility? Success rates vary from close but no cigar to not even close. The Compaq demonstrates how close to "IBM compatible" standard any computer can come. The Eagle Spirit XL approaches the same mark. The Stearns PC proves that better performance need not come at the cost of compatibility, while the Eagle 1600 extends the definition of compatibility about as far as any machine could. ■

MPC 1600-4

Columbia Data Products, Inc.
9150 D. Rumsey Rd.
Columbia, MD 21045
(301) 992-3400
List Price: \$4,770 (with CRT controller)

CIRCLE 713 ON READER SERVICE CARD

A Garden of Portables

Portable—or transportable—compatibles let you bring the power of a PC on the road when you travel, and some add extra features that put them a step ahead of IBM.

Portable, like *compatible*, means different things to different people.

Webster's *New Collegiate Dictionary* defines *portable* as "capable of being carried or moved." This definition would include the 20- to 30-pound computers reviewed here, but we define a truly portable computer as one that can easily be carried by anyone over the age of 10 in reasonably good physical condition, without interfering with the carrying of a handbag or briefcase. A portable computer could be utilized in an environment that is conducive to reading a book or magazine, such as an airplane seat, a library, a doctor's waiting room, the passenger seat of an automobile, a conference room, or a park bench. Thus the computers discussed here are not really portables; they are "transportables," computers that can be moved from office to home or from city to city and that function equally well in any of these locations.

The power of portability really shows up when you arrive at an office or hotel



room, set up the computer, and find it actually works. In Anchorage, Alaska, you can continue writing the report you started in New York this morning.

Portability is an attribute that a compatible manufacturer can use to differentiate

its products from the PC. It is an attribute that has appealed to many manufacturers, and as a result there are many well-designed systems in this arena. There is, of course, concern among these manufacturers that the intrinsic edge portability gives them will be lost if IBM ever announces a portable PC. This concern leads them to continue to design new products. In the last few months, we have seen the advent of the Compaq Plus and the Eagle Spirit XL, two portable hard-disk systems. We expect to see more innovations as manufacturers attempt to remain one step ahead of Big Blue.

We ran a series of tests on each computer, with fairly standard results. Each of the six was able to format, under its supplied version of MS-DOS, diskettes that were readable by an IBM PC. All six loaded PC-DOS properly and ran the IBM Diagnostics and Advanced Diagnostics programs. The Diagnostics program pinpointed errors during component testing with every computer. In each case, error

PORTABLES

101 occurred; errors 201, 301, 401, and 501 appeared in some cases and not others. The appearance of these messages seems to indicate some design differences among the various systems, but did not appear to signify any difficulty with each of the individual computers.

Into each computer we loaded *Word-Star* (Version 3.3) and edited a document, loaded *dBASE II* and ran a name and address application with a data file of 354 records, and attempted to run a program that calculates prime numbers (see Figure 1). This last test produced varied results, depending upon the implementation of BASICA provided. Finally, we successfully file-read read/write tests.

Most of the portables are sold with bundled software. While the software chosen by the manufacturer is often of good quality, we believe that the inclusion of software is detrimental to the average business consumer, because it clouds the issue of software selection. Many consumers who need spreadsheet capability, for example, may be better served by a different product than the one included.

The Chameleon Plus

The Chameleon Plus is one of the most interesting of all the compatibles. Its most intriguing feature is that it contains both an Intel 8088 chip and a Zilog Z-80A chip, providing both PC-DOS and CP/M compatibility. This asset, coupled with the sys-

tem's very reasonable price, makes the Chameleon an attractive computer to any present CP/M-80 user who is considering upgrading to the PC universe.

Besides the two chips, the Chame-

Portability is an attribute that a compatible manufacturer can use to differentiate its products from the PC.

leon's standard configuration includes 128K RAM expandable to 256K on the system unit, two 320K floppy-disk drives, a built-in 9-inch green monitor, a parallel interface, a serial interface, and a keyboard. As options Seequa offers an analog to digital interface, a bisynchronous communications interface, an IEEE-488 interface, an RGB video display interface, and an external expansion unit with eight expansion slots.

Seequa bundles the following software with the Chameleon Plus: MS-DOS, Microsoft BASIC86, *Perfect Writer* word processor, and *Perfect Calc* spreadsheet.

The Chameleon was unable to run the prime numbers program because BASICA is not included on the system's DOS disk. The version of BASIC provided is BASIC86, an implementation with fewer features. The program hung up on syntax errors when it could not execute CLS and KEY, two commands present in BASICA but not in BASIC86. The lack of BASICA on the system is a major shortcoming and one that we expect will be rectified shortly through a distribution agreement with Microsoft.

The Chameleon has come to grips with the difficulty of maintaining two main processors and unique operating systems. No external hardware switches need be set when you are transferring control from

MS-DOS running in a 16-bit environment to CP/M-80 running in an 8-bit environment, or vice versa. The system analyzes the diskette you are booting and automatically directs the system to the appropriate microprocessor and operating system.

The Seequa Chameleon has certainly carved out its own niche with its co-processing features. At \$2,895 for the Chameleon Plus, and \$1,995 for the smaller and older Chameleon, the computer should be attractive to any existing CP/M user wishing to upgrade to an IBM-compatible. (For another look at the Chameleon, see "A Switch-Hitting Portable," PC, Volume 3 Number 3.)

The Columbia Portable VP

The Columbia Portable VP (Very Personal) Computer is the second entry from the firm that introduced the first PC-compatible. The VP, like its desktop predecessor, provides considerable expansion capability and an incredible amount of bundled software for its list price of \$2,995. The VP is slightly heavier than the other portables, weighing approximately 35 pounds.

Its standard configuration includes an Intel 8088 processor, 128K RAM expandable to 256K on the system unit, two 320K half-height floppy-disk drives, a built-in 9-inch green monitor, a parallel interface, a serial interface, a keyboard, one IBM PC-compatible expansion slot, and a socket for an 8087 co-processor.

The bonanza of bundled software includes MS-DOS, CP/M-86, BASICA, *Perfect Writer*, *Perfect Calc*, *Perfect Filter*, *Perfect Link* asynchronous communications system, *VP Tutor*, *VP Diagnostics*, *Home Accountant Plus*, and *Fast Graphs*. The quantity and diversity is impressive, to say the least. The list price of the software slightly exceeds the actual price of the combined hardware and software. The addition of the communications and graphics packages to the spreadsheet and word processing systems offered by other vendors provides the user with a comprehensive decision support system,

Chameleon Plus

Seequa
8305 Telegraph Rd.
Odenton, MD 21113
(301) 672-3600
List Price: \$2,895

CIRCLE 709 ON READER SERVICE CARD

Columbia VP

Columbia Data Products, Inc.
9150 Rumsey Rd.
Columbia, MD 21045
(301) 992-3400
List Price: \$2,995

CIRCLE 708 ON READER SERVICE CARD



PORTABLES

and the diagnostic and tutorial diskettes are useful.

Columbia's documentation packs quite a bit of material into a rather small manual and provides technical information that others, most notably the Compaq, lack. The major limitation of the system is its lack of expansion slots. You'll want to use the only available slot for a multifunction card with additional memory, which thus eliminates the possibility of adding video cards or using the unit within a local area network.

All in all, Columbia has done a good job in providing a very complete package at a quite reasonable cost.

The Corona Portable

The Corona Portable PC is a sturdy portable that performed all the tests satisfactorily. Corona stresses that, for a lower price, its computers provide all of the capabilities of the IBM PC and more. This is a result of the Corona's four expansion slots in addition to its many built-in devices.

The standard configuration includes an Intel 8088 processor, 128K RAM expandable to 256K, two half-height 5¼-inch 320K floppy-disk drives, a built-in 9-inch green monitor, a parallel interface, a serial interface, a keyboard, four IBM PC-compatible expansion slots, and a socket for an 8087 co-pro-

cessor. Corona bundles the following software with its computer: MS-DOS, Microsoft GWBASIC, *MultiMate* word processor, and *PC Tutor*, an instructional program.

During the IBM diagnostics test, the system completely locked up after the error 101 and required turning the computer off and on again to reboot. This difficulty did not occur when running Advanced Diagnostics, which went right on to error 401S.

To run the prime-number program (named PC000001), you must key in GWBASIC PC000001 rather than the conventional BASICA PC000001 that you would enter on the IBM PC and some other compatibles. The difference in name will cause you to edit all of your BAT files (usually AUTOEXEC.BAT files on commercial software) that invoke BASICA to run the applications program and change BASICA to GWBASIC. This difficulty is shared by the Eagle Sprint and by any other manufacturer using Microsoft Advanced Basic under the name GWBASIC.

One striking feature in the running of the tests was the clarity of the Corona's built-in monitor. It is a special high-contrast screen that has even a better resolution than the PC monochrome monitor.

The presentation of the Corona, priced at \$2,945, as a more complete and lower-priced alternative to the PC is valid, and we recommend it as both an initial personal computer and an additional and portable unit.

Eagle PC Spirit XL

The Eagle Portable Spirit XL from Eagle Computer is a sturdy portable with a 10-megabyte hard disk. The design of the system shows an appreciation of some of the deficiencies of the IBM PC, particularly in the keyboard. Eagle has made a number of minor improvements that make the keyboard significantly easier to use. The Enter, or Return, key is labeled Return; there are LEDs to indicate if the NumLock and CapsLock keys

are on; and the Shift key has been exchanged with the backslash (\) key. Eagle improves upon these deficiencies while maintaining compatibility.

The Eagle Spirit XL includes an Intel 8088 processor, 128K RAM expandable to 256K on the system unit (if 64K chips are used) and up to 640K (if 256K chips are used), one 320K floppy-disk drive, a hard-disk drive, a built-in 9-inch green monitor, a parallel interface, two serial interfaces, a keyboard, a color video interface, and one PC-compatible expansion slot. Eagle bundles MS-DOS 2.0, CP/M-86, and Microsoft GWBASIC with the computer.

Like the Corona, the Eagle runs GWBASIC, and the same changes must be made in order to run the prime-number program and other BASICA programs.

Eagle has done a good job of emulating the PC while improving the ergonomics of the unit. Besides the keyboard, other improvements include the movement of the on/off switch to the front of the computer and the inclusion of separate brightness and contrast knobs on the front of the unit. Eagle has provided a complete line of optional interfaces built into the system, and the price, \$4,795, seems reasonable for a system with all of the provided components. However, we would prefer more expansion slots than the one provided, even if it meant giving up the second serial port or the video interface card.

The Hyperion

The Hyperion represents yet another approach to solving the compatible-yet-different equation. The system was designed to be more physically attractive and more technically complete than either the IBM PC or the other compatibles. As such, the cost is higher than most of the other portables.

The system's appearance, accordingly, is quite different. The case was designed by the same firm that designed the Apple Lisa case, and the Hyperion is

Corona Portable PC

Corona Data Systems, Inc.
31324 Via Colinas
Westlake Village, CA 91316
(213) 991-1141

List Price: \$2,945

CIRCLE 707 ON READER SERVICE CARD

Eagle PC Spirit XL

Eagle Computer, Inc.
983 University Ave.
Los Gatos, CA 95030
(408) 395-5005
List Price: \$4,795

CIRCLE 705 ON READER SERVICE CARD





Five portable compatibles: Seagui's Chamelcon Plus, Columbia VP, Eagle's Spirit XL, Bytec's Hyperion and Corona PC

```

100 'PROGRAM PCH00001.BAS
200 'CREATED 01-00-84
300 'AUTHOR MIKE O'CONNOR
400 '-----
500 '
600 ' TO DETERMINE THE PRIME NUMBERS BETWEEN 1 AND 50
700 '
800 '-----
900 KEY OFF
1000 CLS
1100 LOCATE 10,29 :PRINT "IBM COMPATIBLE PROJECT"
1200 LOCATE 11,18 :PRINT "PRIME NUMBER CALCULATION TEST BETWEEN 1 AND 50"
1300 LOCATE 20,34 :PRINT "X1 Y1"
1400 TIMES="0"
1500 SUM A1(50)
1600 FOR X1=1 TO 50
1700 A1(X1)=X1
1800 NEXT X1
1900 FOR Y1=2 TO 25
2000 FOR X1=1 TO 50
2100 LOCATE 20,37 :PRINT " "
2200 LOCATE 20,37 :PRINT X1
2300 LOCATE 20,47 :PRINT " "
2400 LOCATE 20,67 :PRINT Y1
2500 IF A1(X1) OR X1/Y1 THEN GOTO 2700
2600 IF A1(X1)/Y1 THEN A1(X1)/Y1 THEN A1(X1)
2700 NEXT X1
2800 NEXT Y1
2900 LOCATE 20,1 :PRINT SPACE(170)
3000 LOCATE 17,25 :COLOR 9,7 :PRINT "ELAPSED TIME OF TEST " ".TIMES
3100 LOCATE 20,1 :PRINT ""
3200 READ Z1
3300 IF Z1=9999 THEN GOTO 3700
3400 IF Z1<0 THEN F0UL=FOUL+1
3500 GOTO 3300
3600 DATA 1,2,3,5,7,11,13,17,19,23,29,31,37,41,43,47,9999
3700 IF F0UL=0 THEN C0DS="PAIRED" ELSE C0DS="PASSED"
3800 COLOR 23,9 :LOCATE 22,35 :PRINT C0DS :COLOR 7,9 :END

```



Figure 1: This program was run on all the computers except the Chamelcon, which does not include Advanced BASIC.



Lisa case, and the Hyperion is similarly sleek. The keyboard is different and improved: The Shift key is in the right place, and the function keys are along the top of the keyboard rather than on the left side. The keyboard fits snugly below the computer in a bay installed for storage and transportability. The screen is amber phosphor and, unlike other systems, will go into "Wait" (powered down) status when the system has been inactive for 3 minutes. Striking any key will reactivate the screen and bring back the information that was being displayed. This is a nice feature, and we recommend it to all other manufacturers. The amber display is pleasing but the character formation is not as sharp or readable as the Compaq green screen. However, many of our colleagues prefer the amber screen. The system comes with 256K RAM as its base configuration rather than the 128K expandable to 256K that the other units contain. In short, Hyperion has done much to separate itself from its competition.

The Hyperion includes in its standard configuration an Intel 8088 processor, 256K RAM, two 320K floppy-disk drives, a built-in 7-inch amber monitor, a parallel interface, a serial interface, a keyboard, and the following software: MS-DOS, BASICA, and *Aladdin*, a database manager from Bytec itself.

Hyperion

Bytec-Comterm, Inc.
8 Collonade Rd.
Ottawa, Ont., K2E 7M6, Canada
(613) 226-7013
List Price: \$3,690

CIRCLE 704 ON READER SERVICE CARD

Compaq Portable

Compaq Plus

Compaq Computer Corporation
20333 FM 149
Houston, TX 77070
(713) 370-7040

List Price: Compaq Portable, \$2,995;
Compaq Plus, \$4,995

CIRCLE 703 ON READER SERVICE CARD

The system's major limitation is its lack of expansion slots. Hyperion offers separately an expansion chassis and interface that will provide room for seven expansion devices. While this solves the problem for users who plan to utilize the system at a fixed location, it certainly reduces its completeness as a portable. The other units, when equipped with a large memory card, can carry around 640K RAM—a big advantage if the owner is a *VisiCalc* or *1-2-3* user. During our analysis of the expansion point, we found that the built-in serial port provides the intelligence to be connected to bisynchronous devices. The recent merger of Bytec and Comterm has brought 3270 experience and capability into the Hyperion universe. If this connection can be carried to a logical conclusion, it is possible to envision the Hyperion evolving into a very attractive corporate workstation.

The Hyperion is different. It can't compete with the Compaq for full compatibility or with the Columbia for economy. But it is a very interesting product with potential to be a star in certain professional environments.

The Compaq Portable

The Compaq Portable and Compaq Plus computers are extremely well-made systems that passed all the required tests satisfactorily. Compaq has attempted to come as close to full compatibility as possible and, in our judgment, succeeds in coming closer than any other compatible we have seen. We have been using the Compaq Portable for over a year and the Compaq Plus for 6 months, and have yet to find software written for the IBM PC that does not run properly on it. Compaq stresses this commitment to full compatibility and actively pursues software publishers and peripheral manufacturers to test its products.

The Compaq Portable includes an Intel 8088 processor, 128K RAM expandable to 256K, one 320K floppy-disk drive expandable to two drives, a built-in 9-inch green monitor, a parallel interface, a key-

board, three IBM PC-compatible expansion slots, and a socket for an 8087 coprocessor. The Compaq Plus has the same configuration with the addition of a 10-megabyte hard disk. The addition of the hard drive controller takes up an expansion slot on the system, thus reducing the available expansion slots to two. Compaq includes only MS-DOS and Microsoft BASICA with the hardware.

A senior officer of Compaq suggested that we put data on the hard disk in the Compaq Plus, and then drop the computer to the floor to prove that nothing would be damaged and no data would be lost. We were unable to do this because it is against our religious convictions to throw computers on the floor. We did use the system to write this article and were very pleased with its performance.

We are disappointed that Compaq provides no technical documentation on the system's internals. There are no instructions on how to install expansion interfaces. Such documentation would certainly be helpful, particularly because the system switches, while performing the same functions as the PC switches, are reversed in position, and, on the Plus, it is necessary to unseat the hard-disk controller to set the memory switches. This is the only short-coming that we have found in the Compaq line—and we've really given the systems a workout.

Compaq's marketing strategy is interesting. The portable was always advertised as supplemental to the PC—you could run the same software in your home or hotel room on your Compaq that you ran in your office on your PC. This approach brought shelf space in the same independent dealerships that sell IBMs—in fact, these were the only dealers that Compaq sought in setting up its marketing network. Rather than stress price (its prices put it at the high end of the portables), Compaq stresses performance and quality. We feel that the systems perform right up to the image Compaq tries to live up to, and we heartily recommend the Compaq line for professional use. ■

Lifting the Veil of Compatibility

PC's critics answer hard questions with hard data about the imponderable PC compatibles. The newest range from the ordinary to the eclectic in power and configuration.

Yes, I'm afraid it's true. There is a computer called the mad one. Well, that's actually the MAD-1, which stands for Modular Advanced Design 1. Mad Computer, Inc., the Santa Clara company that took the straitjacket off the MAD-1, believes the machine offers much more than mere compatibility and much more than the IBM PC itself. In fact, the company has stated that the MAD-1 will be "the BMW of IBM Personal Computer compatibles." The only problem about making such a statement is that before you can be accepted as the BMW, you have to make sure that you can keep pace with the other PC compatibles

MAD-1

Mad Computer, Inc.
3350 Scott Blvd., Bldg. 13
Santa Clara, CA 95051
(408) 980-0840

List Price: \$4,295 (dual floppy disk unit) \$6,195 (hard-disk unit)

CIRCLE 722 ON READER SERVICE CARD



that are competing on the same track.

The MAD-1 has a good headstart because it is among the handful of microcomputers that use the Intel 16-bit 80186 chip as its power plant. The 80186 is a faster version of the Intel 8086 chip, and

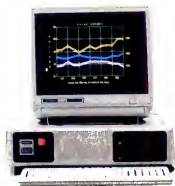
like the 8086, the 80186 can handle data in full 16-bit chunks. The IBM PC's 8088 chip manipulates 16 bits of data internally, but can receive and send information only along data paths that are 8 bits wide.

Though bugs in the 80186 chip have delayed actual shipment dates of the MAD-1, we were able to get our hands on an "almost-there" prototype of the MAD-1. We decided to take it out of its padded box and give it a quick workout.

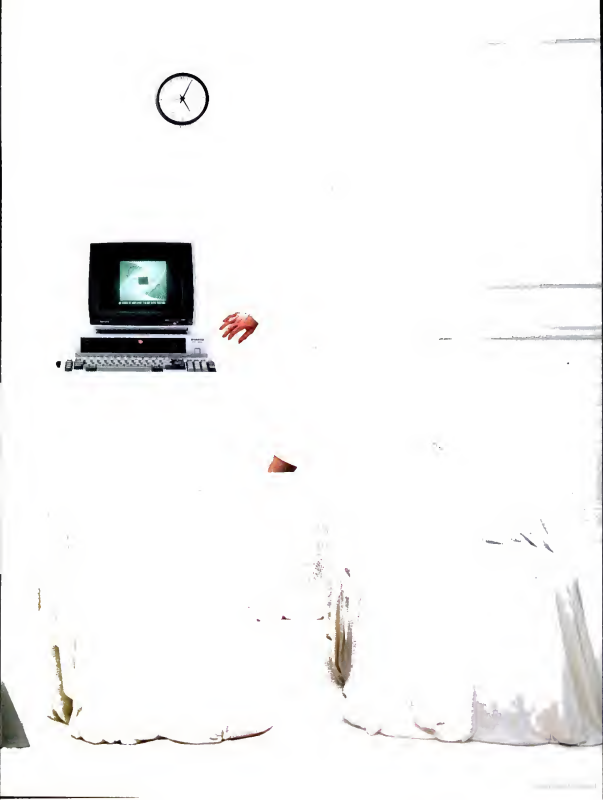
Measuring MADness

To test the MAD-1's compatibility, I first decided to make sure that it was in working order by booting up the operating system disk, a special MS-DOS version 2.0 that came with the machine. Everything appeared to be okay. After checking the contents of the system disk, I carried out my first system test by using MAD's own menu-driven disk-formatting program called MFORMAT.COM. MFORMAT.COM took appreciably longer to prepare a double-density, double-sided









PC COMPATIBLES

disk than the PC-DOS FORMAT.COM program: The MAD-1 program took about 1 minute and 50 seconds to complete the task. The IBM PC accomplished the same job in about 41 seconds.

No problems were encountered when the MAD-formatted disk was inserted in a PC disk drive, and files were loaded from and saved to that disk. The software designers at Mad have been asked to come up with another version of the MFORMAT.COM program that will look and act more exactly like the PC-DOS offering—in other words, no menu. I'd prefer that the company improve the speed and leave the menu presentation as it is.

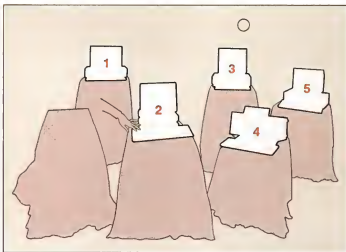
As a prelude to the more formal attack on the machine (see Figure 1), I decided to see if a PC-DOS-installed demo disk for *InteSoft*, the recently announced integrated system from Schuchardt Software Systems, would run on the MAD-1. It did. Consequently, I was not surprised when the A> prompt appeared in normal fashion after I booted an IBM PC-DOS 2.0 disk on the MAD-1. Users will notice that the MAD-1 carries out commands like DIR or CHKDSK faster than a PC does.

But the IBM-flavored diagnostics and advanced diagnostics programs barely allowed the MAD-1's disk lights to flicker before everything went deathly silent. The MAD-1 didn't like these programs at all. Neither did it like the file read/write tests the staff of *PC Magazine* set up. The first program, WTEST, was designed to write 20 1,024-byte records to a disk ten times in sequence. The second program, RTEST, was supposed to read the saved records ten times. On the successful completion of these programs, the screen was to flash the total elapsed time. Each time I

TRS-80 Model 2000

Radio Shack, Tandy Corporation
1400 One Tandy Center
Fort Worth, TX 76102
(817) 390-3011
List Price: \$2,750

CIRCLE 721 ON READER SERVICE CARD



1. Tava PC
2. MAD-1

3. TRS-80 Model 2000
4. Sr. Partner (RL-H7000)

5. Leading Edge Personal Computer

ran the WTEST program, the MAD-1 would display the expected screen prompts and then freeze up after generating a "disk full at address xxx" message.

A specially prepared prime-number calculation program written in BASIC on a PC brought no response at first. The program would not load properly with the GWBASIC supplied on the MAD-1 system disk. But after another try, this time with a PC-DOS system disk, the BASIC program loaded and ran without hesitation. Compared with the other machines reviewed in this issue, the MAD-1's time of 30 seconds is quite impressive. And although the MAD-1 was in fact a little slower in loading *WordStar* than an IBM PC (about 1 second), using the program was quite a satisfactory experience. Lotus' 1-2-3 caused no problems, either; it functioned as it would on an IBM PC. See Figure 1 for a general compilation of test results.

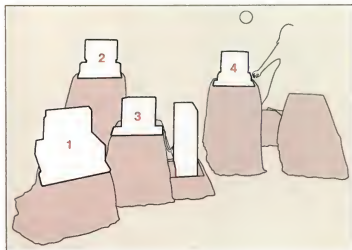
It's pretty clear that the MAD-1 is substantially compatible with the IBM PC at the applications program level. In addition to the software tested by PC, Mad Com-

puters claims that such popular programs as *Volkswriter* (1.0), *EasyWriter II* (2.0), *Easy Filer* (1.0), *SuperCalc 2 & 3* (1.00

The MAD-1 is substantially compatible with the IBM PC at the applications program level.

and 1.0), *SpellStar* (3.30), *dBASE II* (2.4), *Condor Database:3* (2.1), and the generic version of *Multiplan* (1.1) will all run on this machine.

Currently, none of the Visi products from VisiCorp will work on the MAD-1. There are two reasons for this: the special IBM ROM calls made by these programs and the software protection scheme that they use. Presumably, some of the other heavily protected programs on the market fall into this category, too. (Originally, the copy-protected 1-2-3 would not work on



1. Sperry Personal Computer
2. IMP

3. EXTRA-70
4. MBC-555

the MAD-1, but the software designers at Mad refined their system software to the point where it became possible.)

Aware that many customers will not have ready access to IBM PC software, Mad Computers has lined up a number of its own software packages to be distributed under its own label. These include the *MadVision* word processor (actually a version of Microsoft's *Multiplan*), and the *MadAccount* integrated accounting package. You can also run Digital Research's Concurrent CP/M operating system on the machine.

The MAD-1 computer is a pleasure to

use. Its good looks borrow much from the hi-fi/video design world, and it comes with a well-constructed Selectric-style keyboard. There are 10 function keys numbered from F1 to F10. For \$4,195, the MAD-1 offers many built-in facilities that would have to be purchased separately for the IBM PC. The standard MAD-1 comes with MS-DOS 2.0, 128K of main memory, a video controller with color and monochrome support, two RS-232 serial ports, one parallel port, two 360K floppy disk drives, a keyboard, and a monochrome (amber or green) monitor.

The monochrome monitor provides a crisp image. It has a resolution of 720 by 350 pixels as opposed to the IBM moni-

tor's 640 by 200. Built into the MAD-1 is all the video circuitry needed to drive a color monitor, and although the review machine did not come with a color display, I have seen it in operation, and it performed well.

The MAD-1 is made up of two main units: the computing module and the data module. Since MAD-1's developers decided to socket such components as the memory and video chips, the computing module has only one expansion slot. An external expansion unit allows further add-on boards to be connected. The data module currently houses two 360K floppy disk drives. If you wish, you can install a 10-Megabyte half-height hard disk. If you are seeking a true 16-bit machine that uses the MS-DOS operating system and that can handle most of the popular programs written for the IBM PC, then the MAD-1 is certainly worth considering.

TRS-80 Model 2000

Several years ago, the Tandy Corporation was one of the leaders in the micro-computer marketplace. The TRS-80 Model 1 initially sold quite well through the company's Radio Shack retail stores. Now the general view is that Tandy had been unable to keep up with the industry since the introduction of the IBM Personal Computer. One reason is that it dedicated itself to developing proprietary operating systems—TRS-DOS, for example—for its machines, and it held back from offering CP/M compatibility.

The recently announced Tandy TRS-80 Model 2000 marks a major shift in the company's attitude toward the business microcomputer market. Like the MAD-1, the Tandy Model 2000 is based on the full 16-bit Intel 80186 microprocessor, which suggests that the machine is very fast. Instead of developing yet another proprietary product, Tandy has sensibly decided to follow the IBM lead and offer MS-DOS 2.0 as the prime operating system (this move is similar to the big leap Texas Instruments took into the IBM/MS-DOS world with the TI Professional). As a con-

ACTION	MAD-1	TANDY MODEL 2000
1. Format disk on host machine.	IBM compatible	non-IBM
2. Boot PC-DOS 2.0 on machine	OK	Could load PC-DOS, but only list a directory.
3. Run diagnostics.	NO	NO
4. Run advanced diagnostics.	NO	NO
5. WTEST/RTTEST.	NO	NO
6. Prime number test.	30 seconds	1 in 53 sec
7. WordStar load test.	6.5 seconds	NO

Figure 1: Compatibility tests comparing the MAD-1 and TRS-80 computers.

PC COMPATIBLES

sequence, plenty of available packages will run on this machine.

Unlike other IBM PC compatibles or lookalikes, the Model 2000 features two 720K floppy disk drives, and it provides the same high resolution (640 by 400 pixels) in both monochrome and eight-color modes. In fact, it's one of only a few desktop machines for which I might use the word *superb* to describe its color graphics capabilities. Fine lines and the edges of pie charts, for example, are very smooth, and the colors are actually solid.

What about PC compatibility? Tandy is claiming that the machine will run most of the generic MS-DOS software packages available on the IBM machine. Thus, something like MicroPro's *WordStar* should run without trouble, but the Lotus' *1-2-3* package must be revised for the Model 2000 since, in its IBM format, certain ROM calls and its special copy protection scheme make direct compatibility difficult.

The ability of the Model 2000 to read IBM-formatted disks was confirmed when the machine allowed me to list a directory of a PC-DOS 2.0 system disk during the review session; it would not boot the disk, however. During further testing with an IBM-formatted *WordStar* disk, the Model 2000 was unable to do more than list the disk directory, although Tandy claims that *WordStar* will run. The Model 2000's limited IBM compatibility is owing in part to its inability to write information out to IBM-formatted 320K disks. Data stored on IBM disks must be first loaded into memory and then saved onto disk in the Tandy 720K format. Then it can be handled in a routine manner. So while the

EXTRA-70

Digigraphic Systems Corp.
10273 Yellow Circle Drive
Minnetonka, MN 55343
(612) 935-9111

List Price: \$10,695 (with Winchester hard disk), \$6,695 (without Winchester hard disk)

CIRCLE 720 ON READER SERVICE CARD



The EXTRA-70 is fast and expandable, with a removable hard disk.



In Tandy's TRS 80 Model 2000, only the expansion boards are visible.

machine is applications compatible about 50 percent of the time, some disks will have to be copied if you want to do more than just look at the contents of a file or the size of a program.

Like the MAD-1, the Model 2000 couldn't cope with the IBM diagnostics programs (standard and advanced). The disks stopped whirring, and the cursor just sat on the screen waiting for something better to do. Also, as expected, *1-2-3* failed to load. The Model 2000 coped with the file read/write tests, but only in a manner of speaking. After initiating the write test, the machine apparently completed one cycle in 1 minute and 39 seconds. Unfortunately, the next timing to be displayed on screen was 00 minutes and 00 seconds. So while the Model 2000 initially



Mitsubishi's Sperry PC has space only for half-height drives.



Tave's Farsday motherboard provides it with serial and parallel ports.

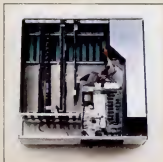
read and ran the program in the proper manner, it encountered trouble when it tried writing to the IBM-formatted disk.

I was hoping to get the prime-number test working on the Model 2000 to compare its speed with that of the 80186-based MAD-1. The program worked fine, but surprisingly, the Model 2000 with its 8-MHz 80186 could only manage a time of 1 minute and 53 seconds. The MAD-1 with its 7.2-MHz 80186 took just 30 seconds to complete the same task.

The Model 2000 cannot yet be certified as a true IBM compatible, but as the Great MS-DOS Hope from a new, more aggressive Tandy, the machine is impressive. Indeed, Tandy's marketing stance seems to be to stress the Model 2000's superiority to the IBM PC, rather than to focus



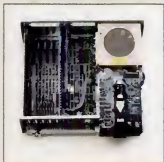
Note the blue wiring fixes: This MAD-1 is obviously an engineering prototype.



Electro Design's IMP has a shielded system bus with 12 expansion slots.



The Sanyo MBC 555's logic boards are tucked compactly under the drives.



The Leading Edge, like the Sperry PC, follows conventional PC wisdom.

strictly on the compatibility issue.

For about \$3,000 Tandy will sell you a Model 2000 with a monochrome monitor, 128K RAM, two 720K disk drives, a display/prINTER adapter, and an RS-232 port. In its brochure, Tandy claims a comparably equipped IBM PC costs \$3,658.

In addition to some IBM software transferred onto Tandy-formatted disks, the Model 2000 will run its own soon-to-be-provided software. These include such word processing packages as Microsoft's *Word*, *MultiMate*, and *PFS:Write*; spreadsheets such as Microsoft's *Multiplan* and Lotus' *1-2-3* (a non-IBM version); and database programs such as *PFS:File* and *dBASE II*. A range of accounting packages and programming languages will also be available.

In keeping with current trends, Tandy has ordered an integrated software package from Ovation Technologies of Canton, Massachusetts, and has agreed to support Microsoft's multiwindowing product, *MS-Windows*. Unless Tandy makes some serious marketing errors with the Model 2000, this computer can be expected to become one of the top MS-DOS machines on the market.

Digigraphic's EXTRA-70

The EXTRA-70 from Digigraphic Systems Corporation is clearly the Cadillac of all the systems PC had available for testing. It offers more built-in mass storage, more expansion card slots, and more of just about everything than a standard PC system. With a price that matches these

capabilities, it is clearly designed for serious business use rather than for the home or for a beginner.

The EXTRA-70 system unit is massive: It looks like a PC with a serious thyroid condition. The unit is designed for vertical floor mounting and comes supplied with the necessary stand. Three full-sized storage device openings are provided. The first holds two half-height 5¼-inch double-sided, double-density, floppy disk drives. The second holds a 10-megabyte fixed, removable hard disk (5 megabytes fixed and 5 removable). The third can hold an optional 60-megabyte fixed Winchester hard disk. The review unit was supplied with the 60-megabyte drive installed, so total mass storage exceeded 70 megabytes!

Of the 10 card slots available, 3 are occupied by the system boards. Unlike a PC, the significant circuitry is on plug-in boards rather than the motherboard. The first Digigraphic card holds the 8088 and a socket for an optional 8087 math coprocessor, floppy disk controller, sound/keyboard interface, one serial port, and 16K ROM. A second card has 256K RAM, a second serial port, a parallel port, and the monochrome display adapter (no color provisions are included in the standard configuration), while the third board holds the Shugart Associated standard interface (SASI) hard-disk (HD) interface. This leaves 7 slots for user-supplied expansion boards, each of which is full length. A heavy-duty 250-watt power supply is hefty enough to handle such expansion, and two fans keep the system even-tempered and cool.

The keyboard is a pleasant change from the Keytronics units supplied with so many IBM clones. Its touch is midway between the Keytronics' slightly mushy feel and the IBM's clickiness. The key layout is like that of a standard PC in all respects. Low profile and equipped with a small palm rest, the keyboard is not as large as some European-style keyboards. Nevertheless, together the palm rest and good touch provide an excellent feel that

PC COMPATIBLES

should be comfortable for sustained use.

Digigraphic does not supply any monitor, but prefers to let the user choose his own monitor.

Incidentally, the Amdek 12-inch amber monitor supplied by *PC Magazine* during the testing was easy on the eyes. The preliminary 40-page manual, though obviously limited, contained more than sufficient information for an experienced user to operate the system.

The manual claims that the EXTRA-70 is "fully compatible" with a standard PC and that the "only restriction in compatibility will be limited to programs that directly manipulate the hardware on the IBM PC-XT." A familiar claim, but for once, the computer lived up to its promotional rhetoric. The EXTRA-70 is, in fact, highly compatible—more so than any other system I reviewed. While neither the IBM diagnostics nor advanced diagnostics programs would run, everything else worked perfectly. Both *I-2-3* and *WordStar*, configured for an IBM PC, ran as they should without any modification (of course, *I-2-3* ran only in monochrome mode, since no color adapter was supplied).

Benchmark testing revealed the floppy disks to be somewhat slower than several of the other systems tested, but the hard disks were quite fast. As the chart in Figure 2 shows, there was no significant dif-

WTEST

Floppy	2 minutes 41 seconds
5-meg fixed HD	10 seconds
5-meg removable HD	10 seconds
60-meg fixed HD	10 seconds

RTEST

Floppy	45 seconds
5-meg fixed HD	7 seconds
5-meg removable HD	7 seconds
60-meg fixed HD	7 seconds

Prime Number Test

WordStar Load Time	59 seconds
--------------------	------------

WordStar Load Time

Floppy	4.8 seconds
5-meg fixed HD	2.6 seconds
5-meg removable HD	2.6 seconds
60-meg fixed HD	2.6 seconds

Figure 2: Test results for the Extra Model 70.

ference between the fixed, removable hard disk and the big fixed Winchester. This doesn't necessarily mean that the drives are identical in speed; often the HD controller is more of a determining factor than many people realize.

The Digigraphic EXTRA-70 is an impressive machine. Unlike almost every other machine tested, its claims for compatibility are justified. With design and construction professional throughout, all in all, it's a most desirable system.

Panasonic's Sr. Partner

The Panasonic Sr. Partner, formerly designated the model HX-1 and now Model RL-H7000, is a portable system distinguished by a built-in thermal printer. In other respects, it follows in the footsteps of many similar PC-type portables, but it has some limitations.

The Sr. Partner uses a 9-inch screen, as do most such units. Unfortunately, there are problems with the screen presentation. The unit emulates the IBM color mode only, so the quality of the type font is only fair, a distinct disadvantage for extended use. To make matters worse, resolution is also only fair. The screen blanks for a fraction of a second when it scrolls up a line, so scrolling is extremely distracting. The

screen even shrinks slightly when you access the disk because of a drop in the voltage (shades of the old Osborne).

Designed with a standard PC layout, the keyboard is not bad. The larger keycaps on keys like Return, plus (+), Ctrl, and so forth are helpful. The feel, though reasonably good, is slightly mushy.

Two half-height, double-sided, double-density floppies are mounted vertically to the right of the screen. Their unusual design uses the door latch as the disk release as well. While they seem to work satisfactorily (although disk engagement and release was a sometimes thing), they feel incredibly flimsy. I wouldn't want to bet on their surviving for any length of time.

The built-in thermal printer works well, albeit at a somewhat slow 55 cps. Like all thermal printers, it is very quiet. Print quality is good; the characters, formed from a reasonably coarse dot matrix, are sharp. The printer appears to be similar to the unit included with the Sharp 5000 portable. Overall it is a definite enhancement to the system.

One serial and one parallel port are provided. An RGB video output is also available to drive an external color monitor. The optional expansion slot on the rear

Sr. Partner (RL-H7000)

Panasonic Industrial Company
1 Panasonic Way
Secaucus, NJ 07094
(201) 348-7292

List Price: \$2,495 (single drive unit)

CIRCLE 719 ON READER SERVICE CARD

MBC-555

Sanyo Business Systems, Inc.
51 Joseph St.
Moonachie, NJ 07074
(201) 440-9300
List Price: \$1,399

CIRCLE 718 ON READER SERVICE CARD

<u>WTEST</u>	1 minute 21 seconds
<u>RTEST</u>	44 seconds
<u>Prime Number Test</u>	1 minute 27 seconds
<u>WordStar Load Time</u>	6.5 seconds

Figure 3: Benchmark test scores for the Sr. Partner.

panel accepts 9.44-inch hardware boards for IBM machines.

The Sr. Partner's PC compatibility is fair. Neither IBM diagnostic disk would run at all, and 1-2-3 bombed the system immediately. On the other hand, *WordStar* loaded correctly and worked well (I did not test whether *WordStar* would print to the internal printer, but I am sure it can be made to do so). Benchmark times are listed in Figure 3.

The Sr. Partner gave a respectable performance, and it offers at least a reasonable measure of IBM compatibility. Unfortunately, the built-in printer is not enough to make up for the poor screen

The built-in printer is not enough to make up for the poor screen display and flimsy drives.

display and flimsy drives. Panasonic makes capable, well-constructed equipment in many noncomputer fields, but to me the Sr. Partner feels like a Jr.

Sanyo's MBC-555

The Sanyo MBC-555 has received a major advertising push in the last few months. Costing under \$1,000 for a single-drive version, the MBC-555 offers a tremendous price advantage over other PC compatibles. Even professional business users have expressed interest in the system as data entry machines or as adjuncts to their lineup of PCs.

Well, the universal maxim that you never get something for nothing is borne

out in the case of the MBC-555. It's not that the machine is *bad*—it's actually rather attractive in many respects. But IBM compatible it's not.

The system unit has a low profile and is finished in an attractive silver color. The 8088 CPU runs at 3.6 MHz, significantly slower than the standard PC clock speed. This will probably throw off timing loops in many commercial programs. Slower parts obviously cost less, but I can't imagine that the cost savings is that great given the relative maturity of the 8088 at this point in its life cycle.

The half-height floppy disk drives are double density but only single sided. Double-sided drives are apparently not available at this time, although it is reasonable to expect Sanyo to offer them some time in the future. Although much useful work was done on IBM PCs equipped with single-sided drives when the PC was first introduced, double-sided drives have become more or less standard. The MBC-555's single-sided drives are thus something of an obstacle to software interchange. Floppy disk drive prices have plummeted recently, and the single-sided drives in the Sanyo are an unwise cost trade-off. At the very least, Sanyo should offer double-sided drives as an upgrade.

The standard system unit is supplied with 128K RAM, expandable to 256K. Since the system doesn't appear to have any provision for expansion boards, 256K probably represents an absolute maximum. This is enough memory for most currently available programs, but those requiring 320K or even more memory are already on the market, and the trend toward increased memory requirements is sure to continue.

The MBC-555 includes one parallel

port; a serial port is available as an option. Though limiting, this level of input/output should be adequate for most users who choose a system in this class.

The keyboard is not similar to IBM's standard, although the influence is obvious. For example, the numeric keypad is also used for cursor movement (an IBM concept that Sanyo might have been better off *not* copying). There is no Alt key, but a Graph key can be used for foreign-language characters and block graphics. There are five function keys arrayed vertically on the left edge of the keyboard; the Shift key must be used to extract all ten functions. The feel of the keyboard is okay, though there is nothing distinctive about it.

The system was tested with a Sanyo monochrome monitor with an image that rates only "fair" in terms of sharpness. Also, the coarse-looking type font could prove tiring after extended use. A nonstandard output jack is provided for an external color monitor, but the manual doesn't specify whether the monitor should be RGB or composite. Even the manual is unlike IBM's; its size is halfway between the IBM standard and a full binder. Apart from occasional lapses, the documentation is reasonably good, and Sanyo versions of the original manuals are supplied for the software provided with the test system, which includes *WordStar*, *EasyWriter 1.3*, *CalcStar*, *InfoStar*, *MailMerge*, and *SpellStar*.

The compatibility testing was more or less a disaster. The MBC-555 uses DOS 1.25 and also features a BASIC interpreter that appears to be a nonstandard Sanyo product. Needless to say, running the IBM diagnostics programs was out of the question. WTEST ran after some minor coding changes, but would only go through a couple of iterations before hanging the machine. Each iteration appeared to run rather quickly (under half a minute), but the computer insisted that they took only 3 or 4 seconds! Obviously something is amiss in the time functions.

RTEST fared even more poorly. Even

PC COMPATIBLES

though the program is well under 20K and the Sanyo had plenty of available memory, the error message—Program Too Big to Fit in Memory—appeared whenever the program was started. Both WTEST and RTEST are compiled BASIC programs and should run correctly, but something is clearly wrong. At least the prime-number test ran; it took 1 minute, 41 seconds.

A *WordStar* disk configured for a PC would not run either. Interestingly, it loaded and the cursor moved to the right places, but the program didn't display the menu. Careful examination of the sign-on messages that show up when the machine is booted revealed that the Sanyo uses nonstandard memory locations for display memory. The *WordStar* supplied with the computer worked fine, though. Lotus' *1-2-3* didn't work, but this was no surprise.

Taken on its own terms, the Sanyo

IMP

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690 Rancheros Dr.
San Marcos, CA 92069
(619) 471-0680
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\$5,456 (IMP-12)

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Computer Systems
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(612) 631-1927 (for MN and Canada)
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Leading Edge Personal Computer

Leading Edge Products
225 Turnpike St.
Canton, MA 02021
(800) 343-6833
List Price: \$2,985

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WTEST

RTEST

Prime Number Test

WordStar Load Time

2 minutes

27 seconds

1 minute 28 seconds

6.2 seconds

Figure 4: Benchmark test scores for the IMP-12.

MBC-555 is a reasonably competent machine. It isn't outstanding in any way, but it obviously offers a lot of computing power for the money. The purpose of this study, however, is to judge PC compatibility, and on this score the Sanyo fails dramatically.

Electro Design's IMP

Electro Design, Inc., submitted two machines for evaluation, one, the IMP-6, with two half-height, double-sided, double-density floppies and the other, the IMP-12, with one such floppy and a 10-megabyte half-height Winchester. Both were obviously early prototypes and were supplied with no documentation. The following tests apply to floppies only.

The system unit on the hard-disk system is about the size of a standard PC, is socketed for the 8087 math coprocessor, and has 12 internal slots. The floppy-only system unit is much smaller, and the two drives are external. This strange configuration may not be implemented in the final production versions.

The keyboard was a "corrected" version of the Keytronics, which exchanges the left Shift key and the backslash/vertical bar key. The keyboard has the somewhat mushy feel endemic to Keytronics; either you like it or you don't.

Electro Design, Inc., evidently lets you choose the monitor you prefer. The test unit had a Taxan RGB attached, which provided sharp resolution and was pleasant to use, given the coarse font used.

Compatibility was quite good, although the copy of BASIC on the system disk didn't work. Discovering that GWBASIC was also on the disk, I tried this version, and it worked perfectly. *WordStar* configured for a standard PC

loaded and operated as it should. Lotus' *1-2-3* would not come up on the hard-disk system, possibly because it was looking for a data disk in the nonexistent second floppy disk drive. Unfortunately, as I was beginning to try *1-2-3* on the floppy-only system, acrid smoke emerged from the system unit, and testing, needless to say, stopped rather suddenly. (See Figure 4 for benchmark results.)

The failure of the floppy unit should not be taken too seriously. The units are prototypes, and we had over a dozen computers running in a rather overheated room. The computer's physical breakdown is certainly not a good thing, but the IMP systems seemed promising.

Two-in-One from Mitsubishi

The Sperry Univac personal computer system and the Leading Edge Personal Computer differ in more than name only—but not by much. On closer inspection, it's clear that they are in fact the same machine decked out in slightly different colors. The basic Leading Edge/Sperry machine is a product of the Japanese company Mitsubishi. The microprocessor of choice is the 16-bit Intel 8088-2, which has an 8-bit data bus design and is software compatible with the Intel 8086/8088 chips.

An important feature of the 8088-2—and therefore of the microcomputers in question—is that the chip can be set to operate at two speeds: 4.77 MHz (identical to the IBM PC) and 7.16 MHz.

The idea behind this approach is that standard IBM PC software, or the software provided directly by Leading Edge and Sperry, will operate almost twice as fast when the machines are put into the "go-faster" mode. Beyond this, the dif-

ferences between the Mitsubishi-manufactured machine and the IBM PC are difficult to distinguish.

For example, the Leading Edge version comes with a keyboard that is more or less a straight copy of the awkward IBM design: The Ctrl, Alt, and Del keys are in the same locations; the backspace key is a backward-pointing arrow (←); the Shift key is indicated by an upward-pointing arrow (↑); and the unhappy mix of the Enter, PrtSc, and right-hand Shift key is still intact. The keyboard generates character codes that are identical to those produced by the IBM keyboard.

Sperry, on the other hand, decided to offer a different keyboard layout to rectify some of the well-known shortcomings of the IBM PC Keyboard: For example, both the CapsLock and NumLock keys are provided with small lights that show when these keys are in a "shifted" mode. Also, the backspace and Return keys are relabeled, directional arrows being replaced

The 3.6 MHz clock speed will probably throw off timing loops in many commercial programs.

with the name of each key.

As IBM compatibles, both the Sperry Personal Computer and the Leading Edge Personal Computer performed well. Although the Sperry technical specifications do not refer to the IBM PC at all, the Leading Edge manual explicitly states that the machine is "fully compatible with the complete range of IBM and IBM-compatible hardware and software" and that "cards made to operate in an IBM or IBM-compatible computer are likely to operate in your Leading Edge Personal Computer."

During the review session, it became clear that as far as the compatibility tests

were concerned, both machines performed in the same manner, with a few minor exceptions. Disks formatted on both machines comply with the IBM standard—a good start for machines that claim they can run IBM software. However, neither computer cooperated when tested with the IBM diagnostic programs. Finally, trying to run the IBM format BASICA system caused the Leading Edge PC to display the message: Divide Overflow (the Sperry machine only got as far as displaying the *D* in *Divide* before it went to sleep).

Things looked up as soon as I tried booting PC-DOS 2.0. The PC-DOS system loaded and performed normally, but any attempt to load *WordStar* under each machine's own system disk foun-
WordStar only ran properly when the PC-DOS disk was placed in drive A; and the *WordStar* disk in drive B.

The next step in the review was to run the file write/read tests. Both the Leading Edge and Sperry machines loaded the file WTEST (with a PC-DOS system disk installed) and both carried out the task in a comfortable 2 minutes and 32 seconds operating at 4.77 MHz.

It was during the write/read tests that the first difference, albeit a minor difference, between the two machines appeared. The Leading Edge machine was outfitted with a standard display: green phosphor on black. It loaded the program normally and displayed the program prompts in the standard 80-column mode. The Sperry machine, which had been delivered with a color display, seemed to interpret the program slightly differently. While displaying the program prompts, it switched from an 80- to a 40-column display mode.

I was not that fond of the character fonts of either machine. The Sperry color display had one particularly irritating aspect: Whenever more than a few lines of text were scrolled on the screen—a fairly common event—the screen would blur very badly. Since the blur, or after-image, of the text had a green hue, this problem

was probably caused by the too-long persistence of the green phosphor. This kind of defect has a relatively minor impact on most DOS-level work, but the impact on using *WordStar* or listing BASIC programs would be substantial.

When compared with the Sperry machine and even the IBM PC, the Leading Edge machine does have an edge. For \$2,895 the Leading Edge PC comes with a 12-inch monochrome monitor, 128K of

Coming Attraction

The Commuter is a portable with promise.

One of the new compatibles that we did not include in our tests is the Commuter, manufactured by Visual Technology, Inc., of Tewksbury, Massachusetts. Visual provided us with an early prototype that was not quite ready for testing. But we saw enough of it to determine that it is a very promising machine indeed.

The Commuter is a 16-pound, 16-bit portable; its standard features will include 128K memory, expandable to 512K; IBM expansion chassis support; IBM graphics support; two half-height floppies; and an optional 16-by-80 character LCD screen.

We will thoroughly review the Commuter in a future issue of *PC* and let our readers know whether or not the machine lives up to expectations and where it fits in the briefcase-sized portable niche.

—Barbara Krasnoff

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main memory, one parallel port, a serial port, and two double-sided, double-density floppy drives (320K). Inside the system unit there are seven expansion slots, although two of these are used immediately to install the disk controller card and the monitor/parallel port card. Additionally, a selection of software—MS-DOS 1.25, Microsoft GWBASIC, and the recently announced Leading Edge word processing package—is bundled in the price. The Sperry machine, which comes only with DOS 1.25 and BASIC, ranges in price from \$2,643 to \$5,753, depending on the configuration.

With two U.S. companies distributing the Mitsubishi machine under their own colors, customers are now being offered a PC-workalike that can be made to operate faster than the IBM machine. But speed is not the main attraction of the Sperry and Leading Edge products. Price is the essential consideration.

Tava, Tava

Another new player in the compatibles game is Tava computer, which in a dark room is virtually indistinguishable from an IBM PC, except for the plaintive howl of the cooling fan.

Tava's entry is based on the Faraday Electronics system board, a 5-slot, 256K board that duplicates the PC in every respect but cassette support and resident BASIC. Actually, it goes beyond the PC's motherboard by including two serial ports and a parallel port. The Faraday motherboard has proved itself to be a reliable and highly compatible vehicle for OEMs who wish to have PC workalike capabilities at a reasonable price.

Our test machine came equipped with a pair of half-height, double-sided Qume

Tava PC

Tava Corp.
16861 Armstrong Ave.
Irvine, CA 92714
(714) 261-0200
List Price: \$2,395

CIRCLE 702 ON READER SERVICE CARD

drives, stacked in the right-hand slot. There was nothing on the left side.

The Tava's performance matches the PC's in all important respects: It boots DOS 1 and DOS 2, runs *WordStar*, *dBASE II*, and Lotus 1-2-3. Naturally, it did not pass IBM's diagnostic check of the system board, since a checksum of the ROM is one of the tests performed. All the others, though, worked fine.

WordStar loaded in 6 seconds from the floppy disk—performance consonant with the machine's PC-like personality. The read test took 1:20 (minutes:seconds) and the write test took 2:40. The prime numbers test, which we executed with BASICA borrowed from the Compaq, took 1 minute and 22 seconds to run.

The Tava has some nice features, such as the knockouts for extra DB25 connectors on the back of the chassis. They solve the problem of what to do with the additional connectors that tend to sprout from multifunction boards. Of course, with the two on-board serial ports and a built-in parallel port, there is little enough reason to add a multifunction card. On the debit side, they might have chosen better drives than the Qumes. Although they are functional, we have our doubts about their long-term reliability, having recently run some of the same drives on an XT to the breaking point. Otherwise, the machine is sturdily built.

The Tava will appeal to the budget-conscious, as it combines a high degree of PC compatibility with the lowest price of any model we tested. It represents a good value. Don't expect the fancy manuals and packaging that go with an IBM, though.

Readers who are toying with the idea of "going compatible" will quickly notice: *PC Magazine* hasn't done all the work for you. The eight machines reviewed in this article were subjected to standardized tests for IBM PC compatibility, not given full-scale performance ratings—and some of the results were not clear cut. Make your final choice on first-hand—your hands—knowledge.

Taking a Closer Look at the RGB Monitor

How does the IBM Color Display produce all those colors? Here's an explanation of both the electronics and the color theory behind the pretty pictures on your screen.

As a PC owner you're no doubt aware of the advantages and disadvantages of the various types of display monitors. But what about color monitors? If you're thinking about buying one, you should take into account resolution, compatibility with other equipment, quality of color, and many other variables—not the least of which is price—before reaching for your credit card. If you're going to go first class, however, of all the color monitors available, an RGB (red, green, blue) display will give the best combination of resolution and color. Before you buy, it's worth understanding how this device works electronically, and how it can produce such a wide spectrum of colors.

As with most things, you get what you pay for when you go for color. Remember, however, as screen resolution goes up, so does the cost. RGB color displays for microcomputers are often advertised as "high-resolution" devices. *High resolution* is a relative term. When used in this context, it usually indicates screen resolution in the neighborhood of 600 addressable picture elements (pixels) horizontally across the screen's axis, and 400 lines or more in the vertical y axis.

Truly high-resolution monitors have 1,000 pixels or more in each axis (over 1 million on the screen). Although these are available, they cost \$5,000 to \$6,000—a price too steep for most microcomputer owners. Monitors of this complexity are

required, however, to obtain "smooth" images with an unobtrusive raster (horizontal grid) pattern. The actual cost is higher than the price of the device, because these monitors require a great deal of memory to address all the picture elements and realize their high resolution and broad spectrum color capabilities.

The most commonly used RGB monitors are similar to the IBM Personal Computer Color Display (640 horizontal pixels, 400 vertical lines). This type of RGB monitor represents a good compromise between reasonable cost and high resolution. As you will see, however, because of memory limitations, the monitor's ability to display color is unavoidably tied to its resolution.

(continued)

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 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



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RGB MONITOR

Red, green, and blue are the only colors that an RGB monitor can display. These three hues may be manipulated, however, so that a viewer perceives almost a full spectrum of colors.

The RGB monitor's screen, like those on color television sets and on all video

ty of the electron beam that strikes it.

The tube contains three electron guns, one each for red, green, and blue. Although these guns fire toward the screen, their beams do not run directly down the main axis of the tube. Each gun is offset so that its beam is slightly angled. The three beams then converge at a point a short distance behind the screen. The beams move downward as they cross alternate lines of dots from left to right. Then, during a second sweep, they cover the intermediate lines. This pattern is called the raster grid.

Phosphor Dots

Obviously, the electron guns do not shoot red, green and blue electrons—that would be too simple. Instead, the angulation of the beams and the use of a "shadow-mask" permit the beams to strike individual phosphors, which, when excited, emit a glow of the appropriate color. These phosphor dots, arranged in triads made up of the three colors, are printed in a continuous pattern over the entire inner

surface of the screen (see Figure 1).

The shadow mask is a thin metallic sheet located just behind the screen at the point where the three electron beams converge. It has tiny circular perforations, one for each color triad. Each perforation measures less than 0.5 millimeter in diameter, which is called the "pitch." (The pitch for the IBM Color Display is 0.43 millimeters.) The three offset electron beams converge and cross at each opening in the mask as they sweep the screen and then separate. The solid portion of the mask shadows each phosphor from the other electron beams, which come through the hole at the wrong angle (hence the term *shadow mask*). Thus, each beam strikes only phosphors of the appropriate color, as shown in Figure 2.

Each group of phosphors that can be addressed, stored, or displayed by the computer represents one pixel. Each pixel is able to generate all colors providing that red, green and blue phosphors are present in equal numbers. The smallest unit capable of doing this would be three dots: one red, one green, and one blue. More commonly, however, pixels are made up of several triads of phosphors (see the diagram in Figure 1). Obviously the more pixels there are, and the smaller they are, the greater the monitor's resolution will be—and the greater its cost. Figure 3 is a photomicrograph of the IBM color display screen showing three high resolution white pixels.

Storing and addressing a large number of pixels requires a considerable amount of computer memory, so much that in its highest resolution mode, the IBM color monitor can only display black and white.

To cut down on memory requirements pixels may be made up of larger groupings of phosphors. Thus when the IBM monitor is in medium-resolution mode, its pixels are twice as large as those used in the high-resolution mode. Figure 4 shows a photograph of two white medium-resolution pixels (note that the red, green, and blue phosphors are present in approxi-

Red, green, and blue are the only colors that an RGB monitor can display.

displays, has inorganic light-emitting phosphors in the three colors deposited on the inner surface of the cathode ray tube (CRT). These phosphors give off energy in the form of photons (phosphorescence) when they are struck by streams of electrons emitted from "guns," which are located in the apex of the cathode ray tube and directed toward the screen. The intensity or brightness of the visible light each phosphor emits increases with the intensi-



Figure 1: A diagram of RGB phosphor triads. The two concentric circles indicate the relative size of high resolution (inner circle) and medium resolution (outer circle) pixels.

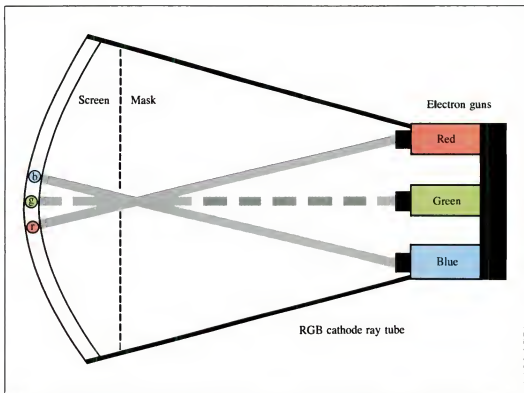


Figure 2: This diagram shows a cross section of an RGB monitor's cathode ray tube. The three phosphors at left are hidden behind the nonperforated portion of the shadow mask (the green phosphor would be located toward or away from the viewer out of the axis of the perforation).

mately equal numbers). Even in medium-resolution mode, the IBM color monitor only permits a palette of four colors at one time. To get the full palette, the monitor must be in text mode (the lowest resolution mode).

On the screen, pixels form a mosaic, which is interpreted by the eye as a unified image. Clearly, pixel size is important in determining screen resolution although a number of other elements also affect it. These additional elements include the size and spacing of the perforations in the shadow mask, the size of the phosphors, the vertical distance between the horizontal lines that the electron beams scan (the ras-

ter grid pattern), and the computer's memory size and its ability to handle color graphics.

Color Mixing

If it only has phosphor dots in red, green, and blue, you may wonder how an RGB monitor produces all those colors. The answer is that it mixes these three "primary" colors. However, you should not confuse this use of the term *primary color* with the artist's primary colors (red, blue, and yellow) that you learned about in grade school. These apply only to mixing color pigments. I am discussing how to mix, or add together, light of various wave

lengths to produce different colors of light.

The electromagnetic spectrum includes many other forms of wave energy in addition to light. These forms include radio, X-ray, infrared (heat), and microwave (radar). Visible light makes up only a small fraction of the spectrum. The wave lengths of visible light fall between 400 and 700 millimicrons. (A millimicron is a millionth of a millimeter.) The diagram in Figure 5 shows the spectrum in three ways. The upper bar represents white light, which is made up of all wave lengths; the middle bar represents (taking into account the PC's limitations) the entire chromatic spectrum; the lower bar

RGB MONITOR

represents the division of the spectrum into the three (additive) primary colors (red, green, and blue).

This span of 300 millimicrons is bounded by ultraviolet light on the upper end and infrared light on the lower. Both of these neighboring "colors" are, of course, invisible to the human eye. (Insects and some other organisms, however, can perceive colors well into the ultraviolet range.) The visible spectrum, which

The visible spectrum, which extends from red to purple, may be divided into any number of colors.

extends from red to purple, may be divided into any number of colors. But if this visible span is divided into only three equal parts, the eye's impression of these three regions will be orange-red, green, and a purplish blue, as shown in the lower color bar in Figure 5.

When equal amounts of light of these three colors are added together, white light is formed. Other colors are created by adding any two primary colors. As you might expect, mixing red with blue light creates magenta—a purple hue. Similarly, mixing blue and green light produces cyan, or bluish green. Unexpectedly, however, adding green and red light together produces yellow. You can see how these colors are formed in Figure 6 where the three primary color boxes overlap.

The RGB monitor produces hues in just this manner. Any other color may be created by mixing the three primary colors in various proportions (but none of the primary colors can be created by mixing light of other colors).

The intensity of displayed colors may be altered by adding or subtracting light. Thus deep red can be brightened to bright

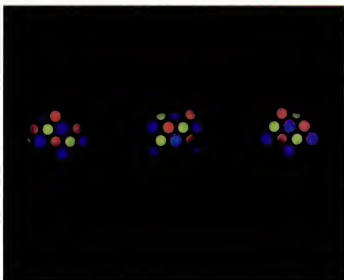


Figure 3: This photomicrograph, on actual photograph of the computer screen, shows three high resolution white pixels. It was made using the intense white bar from the IBM COLORBAR.BAS program on the DOS disk.

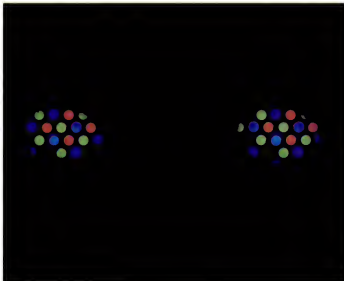


Figure 4: A photomicrograph from the computer screen showing two medium resolution white pixels. These pixels are approximately twice the size of a high resolution pixel.

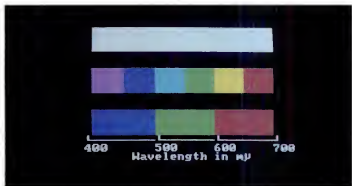


Figure 5: The upper bar, white light, is made up of equal amounts of all the visible wave lengths. The second bar is an abbreviated color spectrum. The lower bar shows how red, green and blue result when the visible spectrum is divided into three equal parts.



Figure 6: Three overlapping color boxes show the formation of the secondary colors, cyan, magenta and yellow. White results in the center, where all three boxes overlap.

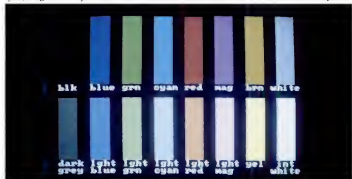


Figure 7: The IBM COLORBAR demonstration program from the DOS 1.1 disk.

red either by increasing the intensity of the electron beam, or by simply exciting more red phosphors.

You can see these color phenomena quite clearly using a good hand held magnifying glass to observe the 16 colors shown when you run the IBM COLORBAR.BAS program included on the DOS disk (see Figure 7). The photomicrographs that follow show how colors are formed on the screen. In Figure 8, intense white is seen to be made up of equal numbers of phosphors of all three primary colors. Figures 9 and 10 show how red and bright red differ. The brightness is produced by increasing the intensity of the electron beam and adding more of the primary color. (I made all exposures under identical conditions: f 5.6 at 1 second, moderately bright screen, on Kodachrome 64 film).

Specialized cells in the light-sensitive retinal layer at the back of the eye respond to specific hues, in a way reciprocal to the one the RGB monitor uses to present color images.

If you examine the color bar, you can see other interesting phenomena. Brown, for example, is reproduced quite effectively on the IBM PC Color Display. Inspection of the PC's brown bar shows that this color is simply low intensity yellow (or dark yellow, if you will).

Although we have not illustrated this here, if you look at COLORBAR-BAS on your color monitor, you can see that gray is actually identical to white except for the number and the intensity of the red, green

RGB MONITOR

and blue dots that create these hues. Thus gray is really just dark white.

The mosaic of bright dots that the color screen presents has to be processed by your brain. Because carrying out physiological research on vision at the cellular level is so difficult, many questions about color perception in higher animals remain unanswered. It seems likely, however, that specialized cells in the light-sensitive retinal layer at the back of the eye (analogous to the film in a camera) respond to specific hues, very likely to red, green, and blue, in a way reciprocal to the one the

If this visible span is divided into only three equal parts, the eye's impression of these three regions will be orange-red, green, and a purplish blue.

RGB monitor uses to present color images. The optic nerve then transmits this retinal cell input to the brain where it is processed into what we think of as "vision."

The graphics capabilities of personal computers and their displays, including the IBM PC's, are currently limited. As display devices improve, however, and as computer memory becomes less expensive, these machines will be able to support increasingly sophisticated imaging and animation techniques. Improving the resolution of color monitors is demanding proposition. (Imagine the engineering and manufacturing precision required to line up the shadow mask with the phosphor dots!) Nonetheless, the potential of computer graphics for the presentation of information, for entertainment, for storing of imagery, and for aesthetic purposes is enormous. ■

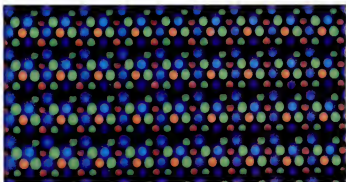


Figure 8: This photomicrograph of the IBM bright white bar shows it to be made up of equal numbers of red, green, and blue phosphors.

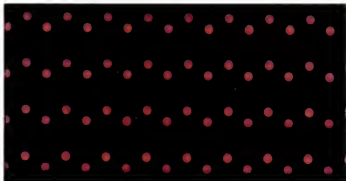


Figure 9: Photomicrograph of the IBM red bar with low intensity excitation of red phosphors. This results in a dull red display.

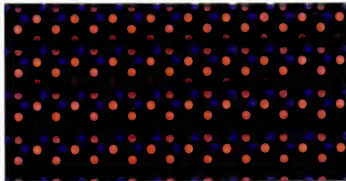


Figure 10: IBM bright red using more red phosphor and higher intensity excitation of phosphors by the electron beam.

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The 16-Bit Seduction of Roger Powell

Rock musician and hacker Roger Powell dreams of a PC music machine that will create sounds no one can hear.

Roger Powell's music is all picture and no sound. It dances in cyan waves on the screen of his IBM PC. When he composes a vibrato or adds a harmonic or two, the oscillators inside the micro really start to shake. "You get these really sexy signs," he exclaims.

Such are the seductive powers of a 16-bit micro.

Although he spends most of his days

and nights at his computer when he's not recording or touring as the keyboard player in the rock band Utopia, the real agent of Powell's seduction is not the PC but his own creation. He is working feverishly on an acoustic compiler that will allow him and other musicians to compose scores on PCs and compatibles, store them, edit them, and then play them back via a custom-built converter plugged directly into a

home music system.

It is an unusual project, but Roger Powell isn't an ordinary rock musician. What other keyboard player in the business can fit in both on stage with David Bowie and at Bell Labs? Who else could back up both rock star Todd Rundgren and Microsoft honcho Bill Gates? Moreover, who else, in this day of instant gratification, could wait months to hear the result of his compositional labors?

Until he acquires a 65-megabyte disk drive and completes his custom-built D/A (digital to analog) converter, Powell will have to be patient. But, he explains, his program, *PC Music*, "is only for those who care enough to wait."

Powell expects that by spring, the IBM PC configuration upon which he has worked for the past 2 years will become the functional equivalent of a full-fledged orchestra, capable of producing any musical sound. It is only a matter of assembling the right hardware; the code, written in C language, is complete.

Career Juggling

Even the most versatile workaholic can't juggle two careers without making some sacrifices along the way. For Powell, most of the sacrifices have been musical. He began a promising musical career 10 years ago when his first album for Atlantic Records, *Cosmic Furnace*, made him the first pop musician to release a commercial LP of entirely synthesized sounds. The album sold poorly but it was named "Keyboard album of the year" by *Keyboard* magazine.

Five years ago Powell toured with David Bowie and released his last solo effort, *Air Pocker*, on Bearsville Records. Then, "for a while, there was no music," he recalls without remorse. "In fact, my addiction to the computer has slowed the production of music. Everybody thought I was nuts. They said, 'What are you doing this for? Computers are for eggheads. You're not making any music.'"

They were wrong. Powell was intent on making music but he wanted to do it his

own way. He likes to compare himself to Harry Partch, an iconoclastic and eccentric 20th century composer who built all of his own instruments, many out of exotic materials. The appropriate musical tools to create the sounds he wanted to make didn't exist. "Partch described himself as

Roger Powell's music dances in cyan waves on the screen of his IBM PC.

a musician seduced into carpentry," says Powell. "I describe myself as a musician seduced into computer programming."

While playing with Utopia in 1974, Powell was one of the first keyboardists to explore synthesized music. The following year he built one of the first IMSAI 8080 computers from a kit. He built his own D/A converter card and used the system to generate notes out of the early boxlike modular synthesizers like the Moog and Serge.

Powell realized that the microcomputer was the easiest interface through which to make music with these passive black boxes. He thought he could write programs to organize sequences of notes and perform the editing within the computer itself, instead of recording music and editing the tape. He soon recognized the increased flexibility of organizing a piece of music this way—the composer's equivalent of a word processor. "I had to build all of that stuff before its time," he remarks.

The hit records on the 1975 pop charts ranged from L.A. acoustic tunes like the Eagles' "Hotel California" to canned pop like the Captain & Tennille's "Love Will Keep Us Together." That year, Roger Powell was touring the country with Todd Rundgren, mystifying the uninitiated with musical electronics and a 20-minute synthesizer/guitar duo called "Mr. Triscuits."

He recalls, "People were still having a

hard time getting used to synthesizers, much less computers, in music. I saw it as another stream of musical development, just another opportunity."

Powell's development took a quantum leap forward when Apple released its first micro in the fall of 1978. He was immediately attracted to it. The 8080 code he had already written had to be switched to 6502, but he finally had a disk drive, and it was relatively easy to get an eight-channel D/A converter card. He would finally be able to make his software efforts available to others. He began to write a program to allow the Apple to control analog synthesizers. The product, called *Texture* (available from Rhinebeat Research, P.O. Box 328, Rhinebeck, NY 12572), wasn't released until 1979; by that time he had recognized the Apple's limitations and realized it was time to leave the orchard.

Faster, Faster!

The 8-bit Apple was fast enough only to read a score and send the names of notes to other synthesizers. It couldn't make the sounds itself even with an AlphaSyntauri card, which, according to Powell, slows down the Apple to half speed because it borrows from the processor time. He needed a 16-bit machine.

That had become obvious to Powell in 1978, when he did a consulting stint at the staid Bell Labs in New Jersey. The blue-jeaned rocker and the white-smocked scientists shared a mutual interest in making music with computers. While Powell provided a musician's point of view, the scientists taught him about the academic side of musical computing. He was particularly intrigued by a program called *Music V*, developed at Bell Labs in the mid-1960s, that served as the basis for all university mainframe sound synthesis languages. The seduction of Roger Powell took another and intensified turn: He decided to translate *Music V* for a microcomputer. But it was 2 years before the right micro came along.

"When the 8086 microprocessor was

introduced, I saw that it was the direction to go in," he explains. "I began to realize that if I was serious about this, I'd have to move on."

A less expensive version of the 8086, the 8088, was planted in the IBM PC, which has been the target of Powell's programming obsession since he bought one in January 1982. His transition was surprisingly smooth; the new code looked similar to 8080 assembly language code he had worked with years earlier.

The configuration that Powell eventu-

ally put together includes a Microsoft RAM card, two 320K drives, a color monitor, a Sigma expansion board with another 256K of memory, and a Plantronics color display board. He later added an 8087 chip.

many sleepless nights writing code. The number of calculations he has computed over the past 2 years is staggering; he credits the 8087 chip with making the program possible in such a short time. Until now, he has only been able to store 5 seconds of sound on a standard 5¼-inch floppy disk, but he knows he can do much more.

"My machine now competes with mainframe computers running sound synthesis languages," he says. "They have loads of hardware, but if you equip your PC with an 8087 chip and a hard disk,

relationships from algorithms and computer-generated structures. Though Powell admits that this is a neat computing trick, it is not something he finds appealing. He waxes eloquent about the "romance" of being a composer today, although it may be difficult to find romance in a pile of hardware.

"I'm not really interested in composing purely intellectual music," he says. "I've been pulling out my hair and staying up all hours of the night to write this code, and if I can make that totally transparent to people when the music comes out, I will have achieved my goal. If they listen to it and say, 'That's nice music' with no idea of the way it was done, then I will have succeeded."

"My goal is to get my total software system going and then make a deal with a compact disk company to do an entire album on my IBM PC. There would be no tape recorders or synthesizers involved, and the final waveforms of my pieces would be directly transferred to a compact disk so there's no air anywhere in the sound. It would be hermetically sealed until it reached your ear."

Today, Powell is no longer the only musician with a computer habit. Popular musicians all over the world are sitting at computer keyboards, transforming the way contemporary music is made. The composer of next year's number one pop single may look more like a hacker than a rock star.

But Powell insists that he is still different from the rest. While his contemporaries have made digital music keyboards the current pop music vogue, he maintains that what he has accomplished with *PC Music* is more important—and he hopes that his work will eventually make those new music machines obsolete.

"Once and for all, I'm going to have one set of hardware that performs all the functions, and I'll only have to change the software. My limitations are speed and memory, but speed is getting faster and memory is getting cheaper."

Another difference is that Powell is



ally put together includes a Microsoft RAM card, two 320K drives, a color monitor, a Sigma expansion board with another 256K of memory, and a Plantronics color display board. He later added an 8087 chip.

The PC's voice capabilities are limited, but ideally it will serve as the engine for the music system that Powell envisions. When complete, it will pump musical waveforms out of the micro into a buffer that will sample the music, filter it into analog, and then ship it to be played through a home stereo. Inside Powell's PC dream machine will be the power of the entire New York Philharmonic, working for nothing and playing all his requests.

It is no simple task. Powell has spent

you're pretty much in the same track with people time-sharing a mainframe. And my program has a lot less overhead."

Worlds Apart

Don't confuse Powell's work with the academic side of music computing, though. There are worlds of difference between a university mainframe lab and Powell's dressing room on the road or his home in Woodstock, New York. And unlike the academics, Powell's ultimate goal is not the means but the music.

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allied with the software marketing clout of Microsoft. He has been working with one of IBM's PCjr development boxes for the past year in cooperation with the Bellevue, Washington-based firm. He has installed

The composer of next year's number one pop single may look more like a hacker than a rock star.

the PCjr's TI chip into his PC and says that with his Plantronics board, his rig can simulate the PCjr's superior musical capabilities quite well. He won't elaborate about the Microsoft collaboration, though he hints, "It could result in a whole front end for my program, and set a standard for synthesizer type interfaces. We're putting a lot of money and effort behind it."

Building Bridges

Powell hasn't left the music business either; he still plays with the current incarnation of Utopia. The band's latest album, *Oblivion*, is now being distributed on its own record label and will be accompanied by a video clip of the band.

Powell is the first to admit that his career would have been different if he had never tried computing. "To tell you the truth, during the last couple of years I've worried about what I was doing," he recalls. "I haven't gotten any real substantial royalty checks for software yet, and I'm buying all this equipment. I don't record in my studio anymore. I've become a different person. But I feel that I'm definitely making headway now. I've always tried to understand both sides of things, computers and music. People like me are needed to make transitions, to try and bridge the gaps between the two arts."

In Roger Powell's mind and career, at least, the gap between computers and music has already been bridged. ■

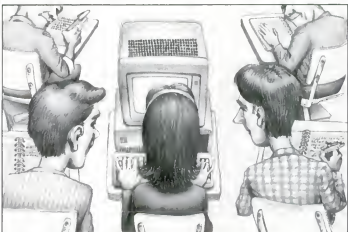
Composing Prose with WANDAH

English students at UCLA are welcoming a new classmate—a word processor named WANDAH. Her creators hope she appeals to the home and business markets too.

From kindergartens to colleges, schools are attempting to make the most of computer-aided instruction. While computer advocates have generally gravitated toward math or science departments in most schools, colleges and universities are still trying to figure out just where else computers can fit into the curriculum.

The University of California at Los Angeles (UCLA) has come up with one solution in WANDAH, an elaborate word processing program that encourages students to think clearly and write good prose. UCLA is beginning to use WANDAH (short for Writing aid AND Author's Helper) in its English composition classes. From there, its creators hope the program, which is implemented on an IBM PC, will spread to other subject areas on campus and then to the home and business market as well.

With a grant from Exxon Education Foundation, a UCLA team—composed of two faculty advisers, two designer/programmers, two student programmers, and design consultants—has spent the last



couple of years designing WANDAH, a young lady whose popularity has already surpassed that of her male predecessor, Wilbur, an editing and formatting program that ran on an IBM 30-33 mainframe.

"WANDAH was written in response to the problems students kept having with

Wilbur," says English professor and design consultant Lisa Gerrard. The mechanics of using a mainframe, plus Wilbur's quirks, made for frustration among the English students. After a hard look at existing word processing programs for micros, the team, headed by Morton Friedman, professor of psychology, and

WANDAH

Earl Rand, professor of English as a second language, decided the software they needed wasn't commercially available. "We couldn't find anything that was user-friendly enough or oriented in the right direction," says head programmer Michael Cohen. "They were all designed for transcription, not composition. So, we had to bite the bullet and design one."

With teacher involvement in mind, the team gathered all the features that might be included in *WANDAH* and laid them out for scrutiny by the English department faculty. "We told them what the machine could do and asked: 'What would you like it to do? What features would you use in your classroom? What would you avoid using?' The teachers had no knowledge of computers, but they knew how to teach English, and that was an essential point of view," says Cohen. "They told us what they wanted, and we gave it to them."



On the PC's numeric keypad, commands for WANDAH are on the top half of each key above the original key marking.

A Look Inside WANDAH

What UCLA's writing instructors wanted was a tool that would encourage students to organize their ideas, write and edit compositions, and polish their English skills. **WANDAH** meets these requirements in three ways—with prewriting aids, a word processor, and revising aids. The modules in each part were drawn from literature on teaching methods and from first-hand suggestions by teachers.

WANDAH's prewriting aids provide practice in developing writing skills. "Freewriting" is a module designed to unblock writers' blocks and let ideas flow; it works by having the student write at the keyboard for about 10 minutes without stopping. If a student stops typing for more than 5 seconds, the last line of text blinks alternately with the words "Don't stop typing." The user can't hit the backspace key or do anything except keep on typing.

The "nutshelling" module is a planning device. Screen prompts ask the user to state the title of the paper to be written, what the user will try to accomplish with it, who is going to read it, and a brief

summary of the ideas that will be presented in it. The responses are saved on disk and can be brought back up on a split screen for reference while writing. "Invisible writing" is a technique used for students who start a draft and then block, only to go into a cycle of rewriting what they've already done. With invisible writing, students can't view what they're typing; the cursor just moves along by itself on the bottom half of the screen, while the top half shows an outline from the nutshelling or planning module. In this way, the student is forced to think about his ideas rather than how he is saying them.

Once they've warmed up and their thoughts are in order, students can write and edit with *WANDAH's* straightforward word processing program before starting revisions.

WANDA's revising aids are still in the works, but its designers plan to include features for helping students with English mechanics, style, and overall organization. Mechanical aids include simple punctuation checks, with a search for syntactical problems. For instance, if a period

appears after an end quotation mark, **WANDAH** will highlight it. If the student presses the E key an explanation appears, such as "A period usually goes inside the quotation marks." Then **WANDAH** leaves it up to the student or the teacher to decide. A spelling checker and a word usage checker are in the works.

WANDAH's Stylistic Analysis Program scans a student's writing and highlights and counts the occurrence of certain classes of words. These classes are forms of the verb "to be" (to alert students to use of the passive voice), prepositions (to point out unwieldy clusters of prepositional phrases), gender-specific nouns, vague or abstract nouns (such as "basis" or "area"), and words ending in "-tion" or "-sion" (which are often action verbs that have been turned into nouns). By highlighting words in these classes, **WANDAH** alerts the student to what may be an "unstylish" preponderance of one class or another.

Because the limited view of the text on a word processor often creates disjointed writing, *WANDAH's* organizational aids

WANDAH

are designed to ensure that papers flow smoothly. One section of the program goes through the text and highlights transition words and devices so students can see where they appear and if they are linking the ideas smoothly. Another feature, the sentence outliner, highlights the first and last sentence of each paragraph in a separate text block so students can evaluate a paper's continuity. There is also a postwriting nutshell, much like the pre-writing nutshell.

To date, WANDAH is being used primarily in UCLA's freshman composition and remedial English classes. Some of the classes meet in WANDAH's lab, which is outfitted with ten IBM PCs and four Epson printers. Six more PCs are being added, on loan from IBM until the project testing is finished. There are also five PCs, each equipped with an NEC Spinwriter, in the faculty offices where professors can test the program and dawdle in privacy. "We felt that was really important," says Friedman. "A lot of the professors are afraid of making mistakes in front of students, so they feel more comfortable learning it on their own."

WANDAH's Growing Pains

Early in the process, the WANDAH design team ran the program on an Apple, but when the IBM PC was introduced they switched to it as the standard. "We knew we needed twice the memory of an Apple and a more extensive keyboard, so the PC looked like the best target machine," says Cohen. "We had originally decided to do it in the p-System with UCSD Pascal because it could be implemented on a wide variety of micros."

WANDAH was developed concurrently on the PC and on Cohen's Sage II computer at home. Because the Sage II supports the p-System, he was able to customize WANDAH to work on it. In fact, it turned out to be an ideal combination. "The PC is a wonderful machine to run it on, and the Sage was a good machine to develop it on," says Cohen. "And the p-System was the perfect operating system

to communicate between them."

To head off the possibility of the program fading away unused, teachers and students were involved in WANDAH's

WANDAH's revising aids include features for helping students with English mechanics, style, and overall organization.

development from the beginning. "From past experience," says Friedman, "we knew how important it was to get writing instructors involved from the start. That way we were developing a program they would actually use rather than developing it and forcing it on them."

The team worked to make WANDAH a program that would assist the teacher rather than do the instructing. "With some

programs, the computer does the teaching, and that's just not the best use for it," says Cohen. "A computer is like a blackboard. It's a wonderful invention. It's erasable and you can do all sorts of things on it, but it isn't going to teach a class. You need a teacher to do that." WANDAH hands over control to the teacher while still providing a vast array of aids for the student. "With WANDAH the teacher has the freedom to say 'Avoid the freewriting section. For your purposes it's a dog.' Or, to another student, to say, 'You are revising the same thing. Why don't you do some invisible writing and see if it unblocks you,'" explains Cohen. In other cases, WANDAH may suggest how to approach a stylistic matter, but it's up to the teacher to explain what the output means and judge its validity. Cohen stresses (with a smile) that, though WANDAH is a charming lady, she is just like any other computer program—she doesn't presume to understand English. She can pick out passive voice, find comma splices and open quotes, or look for a word like *can* and *should* at the beginning of a sentence and then check for

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WANDAH's planning module makes students get their thoughts down on the screen before they begin writing a thesis paper.

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WANDAH

a question mark at the end, but she's still just computer software.

Simple and Straight

The team motto has been "Find the simple way, and talk English." Students

The team motto has been "Find the simple way, and talk English."

using WANDAH are not "editing a document," they are writing a paper. Some of the PC's function keys have been replaced by "plain English" keys—for instance, pressing the "tidy" key cleans up the screen after a lot of deletions and additions. "We put on some keys that say something about writing," says Cohen. "It seemed more rational than pressing F10 and wondering what happened. And for naive users we included extensive safety features. There's even a restore key that brings back what was erased."

Testing along the way has provided feedback on what features were needed and what was too complicated. A trial version of WANDAH was sent to a test site at the University of Minnesota, where students used it and sent their feedback. Features were added, dropped, and expanded based on the students' comments. One problem was that the students weren't formatting their papers for printing because it was too complicated. To fix things, Cohen included a viewing mode. "We developed the perfect compromise between the 'what you see is what you get' processors, where all the formatting is happening in front of you and it drives you crazy, and the WANDAH-type screen, which puts as much text as possible on the screen so you can see the context you're viewing in. In the view mode, you can preview how it will print out."

During the 600 pages and 34,000 lines of WANDAH's development the team discovered the meaning of the saying, "A

feature is a bug that's been documented." The fact that the text files are only 15,000 words long is one bug that has turned into a valuable feature. It forces users to break up their work into reasonable units, but WANDAH can link them for printing.

Still to Come . . .

Other possible applications have already been informally tested by Cohen. "I have this horrible obsession," he says. "I write sleazy science fiction that I show only to my friends. I'm using WANDAH right now to work on my latest novel." Cohen, a confessed hacker who loves the complexities of programming, has found that he is delighted with the simplicity of WANDAH. "It doesn't bother me that it's menu-driven. And with WANDAH's style program I can get up-to-date word counts any time. I also use the split screen to take a look at what I wrote in the last chapter," he says.

Friedman envisions adapting WANDAH's prewriting and revising modules to everything from business and technical writing to law and psychology. "It could work well for anyone who wants to organize their thoughts, because it forces the user to get ideas down in an organized fashion," he says. They are deciding on a publisher now.

There are still a few things to be added, such as modules for footnoting and checking for clichés, with more bug reports expected. And over in the sleek lab stocked with shiny IBM PCs, Cohen sighs as Ruth Von Blum, his coworker, heads into the room with another feature that just *must* be added. "It's become a ritual with the student programmers and me when Ruth says there is something we have to include. I say, 'Do you know how much time that will take?' We complain, then we do it. We have to make the changes. It's not worth it to put out a product that isn't the best we can do, but sometimes . . ." Cohen's complaint trails off into a murmur as he scratches his head, settles down at his PC, and punches up the free-writing module. ■

An IBM First for Secondary Schools

IBM has joined with the Educational Testing Service to boost computer-aided instruction in secondary schools and help end the rising tide of mediocrity in American education.

It seems that everywhere we turn today we are confronted by the computer. Turn on the television for computer commercials. Open up the newspaper for ads displaying hardware and related products. At parties guests huddle together to discuss their latest computer discoveries. Dozens of computer magazines have sprung up along with clubs and networks of users, and innumerable businesses are either planning or implementing the computerization of their operations. Even the American home is not immune.

In one institution, however, computers have played a secondary role—the secondary school. But that's all changing—and in a "Big Blue" way.

On July 1, 1983, IBM began an ambitious 1-year program to demonstrate the plausibility of implementing computers in high school education. "Big Blue" allocated approximately \$8 million to the IBM/ETS Secondary School Computer Education Program to provide hardware, software, training, and support to 89 target high schools in three states—New York,



California, and Florida (chosen primarily for their proximity to IBM's largest facilities).

IBM contracted with the Educational Testing Service of Princeton, New Jersey, to design and administer the program. Thus, the same folks that bring you the SAT are now demonstrating a successful

and progressive model for computer-assisted instruction (CAI) in secondary schools. The program's objective is not to turn students into programmers but to give them computer skills for the real world. Students are learning to apply commercial software in innovative ways to their day-to-day activities.

SECONDARY SCHOOLS

According to Dr. Michael De V Roberts, project director for IBM, the IBM/ETS Secondary School Computer Education Program will clear a new path for CAI. Until now, he says, CAI microtechnology has not been used effectively in secondary schools. And, in fact, until the arrival of the PC, IBM didn't believe that any of its machines were appropriate for secondary-school level computer education of the kind contemplated in the current program. The introduction of the PC, combined with the recent national outcry against the "rising tide of mediocrity" in American education, helped launch the IBM/ETS effort.

A Back Seat for Programming

IBM is certainly not the first computer manufacturer to tap into the educational market (see "Student Aid From IBM And Apple," PC, Volume 3 Number 3). Its approach is one of the most innovative, however. To date, most of the programs sponsored by the various computer firms have been tied to the old belief that computer literacy depends exclusively on mastering programming. The IBM/ETS Secondary School Computer Education Program is making an impressive attempt to transcend this limited notion and to redirect the use of the computer in education. The IBM/ETS program deemphasizes programming as a principle of computer learning.

Instead, its strategy is to open up the computer to everyone, on the assumption that it's no longer necessary to understand programming to enjoy the machine's benefits, no matter where in life you use it—school, business, or home. This unique approach encourages the use of a readily available and ever-increasing quantity of generic software to aid students within already established curricula. For instance, word processing programs are used for teaching and improving English composition and creative writing, spreadsheet programs for business classes, and database management and graphics software for the sciences.

IBM supplied each participating school with a software package that included PC-DOS, BASIC and Pascal, *EasyWriter*, *pfs:File* (a database manager), and *pfs:Graph*, as well as other programs to aid in the operation and maintenance of the equipment. ETS solicited software donations from other vendors and obtained Spinnaker Corporation's *Delta Drawing Learning Program*, *Computer Discovery* (an elementary-school-level computer-assisted instruction program available from SRA of Chicago), and the ever-popular *VisiCalc* for the schools. Drawing on an additional limited budget, the schools can choose from a shopping list of specialized generic software, depending upon needs of their particular curricula.

In addition, each school is entitled to 25 free hours per semester on The Source news and information service. Through

The Source, the 89 schools involved in the project can establish their own networks to communicate with each other for the exchange of ideas and can learn individually to utilize the various information libraries available.

IBM provided well-equipped computers to run all of this software. The substantial equipment package delivered to each participating school included 15 IBM PCs (each consisting of a keyboard, a system unit with 128K RAM, two single-sided disk drives, and a high-resolution color monitor), three IBM PC Graphics Printers, and one Hayes Smartmodem. The schools will own the hardware after IBM's participation in the program ceases at the end of the school year.

In return for this generous endowment, each school assumed a considerable financial burden. As part of their commitment to the project, the schools are responsible

Profile of Participating Network Schools

Size of Schools in Terms of Total Student Enrollment

2,500 students or more.....	16%
1,000 to 2,499 students.....	48%
500 to 999 students.....	25%
1 to 499 students.....	11%

Location of Participating Schools

Urban schools.....	32%
Suburban schools.....	47%
Rural schools.....	21%

Types of Participating Schools

Public schools.....	79%
Religious schools.....	13%
Independent schools.....	8%

Schools With Students Going From Families Below The Poverty Index*

25% or more students from poverty families.....	10%
12 to 24.9% students from poverty families.....	46%
5 to 11.9% students from poverty families.....	27%
Less than 4.9% students from poverty families.....	17%

*Poverty data were available only for the public schools; percentages are therefore based on the 70 public schools participating in the program.

Profile of participating network schools

SECONDARY SCHOOLS

for any special classroom construction needed to support the computer setup, including provision of the on-site physical facility, special electrical hookups, wiring conduits, desks, telephone lines for the modem, storage space, and security for the hardware. In many cases, substantial funds were necessary to take advantage of the IBM gift, which caused some schools to debate seriously whether or not they could afford to participate. Even so, the schools endure far less financial strain than they would building such a program without IBM's expertise and support.

IBM took great pains to set up a multilevel system for administering and monitoring the Secondary School Computer Education Program. At the top of the pyramid is IBM itself, supplying the basic funding and most of the hardware and materials. Guided by IBM's goals, the Educational Testing Service designed the actual program. They are also responsible for its administration.

Under ETS is a network of 12 Teacher Training Institutes (TTIs), four in each of the three participating states. Each TTI is further responsible for from seven to nine individual high schools. The TTIs were chosen principally from colleges with graduate programs in teacher education and experience with computers in education. There are, however, a few TTIs, such as the Los Angeles Teacher Education Center, that are not colleges, but that fit the criteria.

The decision about which high schools would participate was made by ETS, based on broad institutional and demographic criteria such as type of institution (private or public), racial composition, urban/rural status, and socioeconomic status. Once the schools were chosen and the more than 350 representatives selected, a comprehensive and intensive 4-week training session was set up at each TTI during the summer of 1983. The summer program was designed primarily to develop and prepare a school site implementation plan for the teachers to take back with them to their schools. Graduates of the



summer course would then train their fellow faculty and subsequently their students.

The month-long, 5-day-a-week, 9 a.m. to 4 p.m. schedule covered everything the teachers would need to know in order to design, set up, and run their computer-aided classes. They were first taught how to unpack the equipment and assemble everything—no small task for nontechnical, inexperienced people faced for the first time with multipin cables and multiple cable attachment ports.

Each day's schedule included workshops and instruction on the various software packages, tips on using and maintaining the basic hardware, reference journal reviews, development of curriculum lesson plans using the computer, and the process of telecomputing. In addition, the teachers were treated to lectures by specialists on such subjects as using computers in the secondary schools, the ethical issues involved in using computers in the classroom, and the theory of educational change.

Principal Support

IBM and ETS realized early on that the support of the selected schools' principals would be essential to the success of the program. Principals from the participating schools were, therefore, invited to the Teacher Training Institute for an orientation session that familiarized them with the project and its goals.

Once the 4 weeks were over, the teachers set about implementing the program in

their schools. Monthly meetings were scheduled for the rest of the year to assess the progress of the project, address any problems, review new software, and help maintain teacher confidence.

Though the TTIs offered guidelines for hardware and software use, the teachers were encouraged to develop their own ideas about how to integrate the materials and equipment into their curricula.

Most of the teachers entered the summer workshop like students on their first day of school. Many were unfamiliar with computers and confused about how they could be used in the classroom other than for teaching programming. But after 4 weeks of computer instruction, most of them returned to their schools armed with a better understanding of the PC and its educational potential.

In the schools, the program is designed around computer lab classes of approximately 30 students each, with two students assigned to each computer. The ETS and TTI staff remain available to aid and support the teachers throughout the year-long project.

Signs of Success

As the school year winds down, just how well is the project working? One measure of its success is the vigorous school networking that has developed. Schools connected via a common Teacher Training Institute have banded together for mutual support and learning. These local networks are crucial to the program's success, according to Randy Bennett, director of network support for ETS. "What we hoped would develop was a sharing relationship that would keep the staffs in the different schools in each local network together and help them develop a dialogue." There is already evidence that this is happening, and it can be seen as a symptom of the good health of the overall program, which appears to be accomplishing just what IBM hoped it would.

In addition, there are many surprisingly imaginative and innovative applications of generic software beginning to turn up in

The Blackboard Bungle

Numerous problems and political infighting abound in the IBM/ETS program for computer-aided instruction in secondary schools.

If you're so smart, how come you're not perfect? Even the combined brains and resources of IBM and ETS (the Educational Testing Service) could not answer this question. Neither did they not guarantee a problem-free program for computer-aided instruction. Bottlenecks and political infighting created numerous obstacles to the I in CAI.

The first bottleneck occurred in the planning for the initial summer workshop. The Educational Testing Service proposed its project model to IBM during the winter of 1982. It was almost spring of 1983 before IBM gave the final approval to proceed, and by the time the Teacher Training Institutes were selected, ETS faced a July 1 deadline to arrange for the participation of the high schools. Choosing the schools and assessing the level of interest and commitment of each school's principal proved so time consuming that ETS was backed up against a wall.

As the summer loomed closer and closer, it became evident that there might be a problem with teacher selection for the 4-week workshop. Some of the teachers selected by their schools to attend the TTI had already made commitments for the summer session. Others chosen to replace them weren't scheduled to teach the types of classes that would bring their students in contact with the computer. Granted, this was not a major problem overall, but certain individual schools were potentially greatly affected.

Because so many teachers were unaware, when classes ended in June 1983,

of the on-coming computer program in their school, there were some isolated problems in briefing faculty before the new school year began in September. And, of course, once classes started, the fresh workload made it difficult for teachers to schedule time for computer training. Certain teacher reps were left to struggle with squeezing in training, working out scheduling, and handling their own classes.

One of the biggest and most frequent snags was that in many schools the hardware and the physical facilities weren't ready when school began. In theory, the schools made a formal commitment to provide the space, security, telephone lines, electrical hookups, and maintenance necessary to support the IBM equipment. In many cases, either the equipment didn't arrive on time (some schools didn't get their computers delivered from IBM until October) or the school hadn't completed the computer facility to handle it. The students, of course, were eager to get hands-on experience with the new equipment, so the pressure on the faculty to push ahead was intense.

In-School Competition

An additional and serious, but perhaps predictable problem that surfaced was the rivalry between the established data processing faculty and the new IBM computer "upstarts." At Santa Monica High School, for example, after the teachers who had trained at the TTI got the program on site and implemented, the data

processing and computer classes monopolized all the time available on the PCs. The classes designated to use the machines, once excluded, have had great difficulty reserving machine time. So far, only about 10 of 120 faculty members have gotten their classes scheduled to use the PCs. This sort of bureaucratic infighting, so common in the schools, could seriously undermine the success of the IBM program and diminish its value and benefits to students.

Bob Perry, a biology and marine sciences teacher at Santa Monica High and a principal participant in the IBM program, explained his frustration: "I think IBM has done everything it can. What we're dealing with is a local, on-campus, political situation where the data processing teachers were the ones who knew how to use the machines; they got on them right away and just hogged them for their classes."

Other problems, such as shortages of supplies, illustrate a lack of real support from principals and school administrators. Just keeping printer paper in stock has proved a major undertaking in many schools. In some cases, teachers have paid for paper and other supplies out of their own pockets.

A Source of Trouble

Even so routine a procedure as utilizing The Source has proved an administrative hassle. Again, Bob Perry identified the issue. "We've been unable to formulate a policy as to how to use our time that we've

been given on The Source. In other words, if we left the phone hooked up to the machine that has the board all the time, anybody could go in there and they could be ordering things from catalogs, or checking the 10th race at Santa Anita through The Source. We're trying to get guidelines on that first."

In addition, some schools have refused even to install the necessary phone lines because of fear of unauthorized student use and the potential for computer crime.

Another concern, again a factor of school policy, is which individual students actually get time on the PCs. Many teachers, already faced with severely limited access, are allowing only their better students onto the machines. One business teacher summed up her dilemma: "Students without good verbal skills will have problems with the computer. If they can't type more than 40 or 50 words per minute, what good will a computer do them?" In other cases, access to the computer is used as a reward for good behavior in class.

It may be harsh to call these teachers unfairly discriminatory, but it does appear that the slow learner or mediocre student is getting shortchanged in some classrooms. Regardless of scheduling problems, one of the program's key goals is participation by students at all levels of academic competence. And in light of research that illustrates the value of computer learning for educationally disadvantaged students, this questionable selection policy could use some reevaluation.—H.B.

the schools.

An 11th-grade class in New York state is applying *pfs:File* to a statistical project on global social problems. Acting as the leader of a specific country (whose vital statistics the student must research), each student uses the software to help build a world database containing death rates, per capita income figures, and other vital facts. The goal of the project is to discover various factor correlations for each country (for example, correlations between death rates and per capita income levels).

In a biology project in California, students are comparing a cell's size to its ability to take in materials and nutrients. Originally, cells were measured either by hand or with the aid of a simple routine in BASIC. Now, with *Delta Drawing Learning Program*, students have been able to simplify the routine. They also have the additional ability to display the cell graphically, showing with different colors how the materials diffuse.

In a senior-class ecological study in marine science, students use various instruments to obtain water quality samples off the Pacific coast to collect data on air temperature, surface temperature, water color, salinity, and surf size. The bird, fish, and mammal populations are counted and identified by species, and microscopic water samples are taken back to the school lab, identified, and quantified. All the activities are charted on the PC with *pfs:File*. Then the data are graphed with *pfs:Graph*. The purpose of the project is to do a complex analysis of the various populations, to explain why they change, and to show what factors affect the changes.

"The ultimate goal for this semester," says Bob Perry of Santa Monica High School, "is for students to write a major, long-term research project using word processing, and to use the computer to do basic calculations for algebra, maintain records of the data, and then ultimately access the file and graph it. Virtually all the mechanics of the project can be done

by the computer, and the thinking can be left to the student."

There are other unique applications in the three target states that go beyond the software's original use. *VisiCalc* is being used to teach physics, *EasyWriter* for modeling DNA molecules, and *pfs:File* for American history lessons.

The schools will be responsible for maintaining the equipment and carrying on once IBM's involvement ends.

This all pleases Dr. Roberts: "There was some criticism by the relatively uninformed press that says we foisted a gang of business software—that's the pejorative phrase used—on the schools," he says. "That absolutely isn't the case. People dreamed up database applications long before anybody thought they'd be useful for business. Now it comes full circle back to the imagination of the people."

As the year progresses, more and more uses for the project's software will surface from inside the classroom, and the students using the computers will undoubtedly gain invaluable knowledge to carry with them to college or into the business world. But what will happen on June 30, 1984, when the project formally ends and IBM and ETS are no longer around?

The Program's Future

According to Randy Bennett of ETS, the successful continuation of the project depends heavily on the teachers and the local networks set up through the TTIs. "Our hope in designing the program was that schools would continue to interact with each other. That was the whole idea in setting up the network concept of grouping schools together. Each person in

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SECONDARY SCHOOLS

the network will be able to contribute some sort of unique interest or knowledge that will be helpful to the others."

On the down side, the schools will be completely responsible for maintaining the equipment and carrying on or expanding their own programs once IBM's involvement ends. And there is a fear that school administrators, whose budgets are already squeezed, will have difficulty justifying funds for additional hardware, new software, teacher training, and supplies.

Regardless of potential problems, the students are the real benefactors of this program. Today's students are conditioned at an early age by television to assimilate information from a screen in programmed 1-hour, ½-hour, and 60-second bursts. Sitting passively for hours in a large classroom while the teacher lectures and illustrates lessons on a blackboard can only reduce their ability to learn. Computer-aided education of the kind made possible by the IBM program dramatically reverses this uninspired approach.

Michael Washington, a tenth grader from Wilmington, California, said that a number of teenagers at his school who formerly "hung out" with gangs discovered the computer lab and with it a purpose for attending school. They realized that computers were fun, they could understand how to use them, and they could learn something from them.

"When I first walked into the computer room," Michael said, "I thought there would be a lot of those people with glasses on. I wasn't into being a hacker. But I found there were quite a lot of people like me. We're a tough computer class."

"You can argue about whether or not the micros substantially change test scores," says Dr. Roberts, "but you must get the kids into the schools before you can have that argument." The IBM/ETS Secondary School Computer Education Program is making itself felt in that respect. As far as its future plans, Big Blue is silent. But this project just begins to tap the potential of the PC for the world of education. ■

TI's Model 855: A New Definition for Letter Quality

Texas Instruments' Model 855 printer exemplifies the new era of letter-quality dot-matrix printers. The speed and flexibility of these machines may turn daisy-wheel printers into dinosaurs.

In the early days of microcomputings there were two kinds of microcomputer printers: expensive, daisy-wheel printers that produced attractive results, and cheap, dot-matrix printers that didn't. Now, there's a third kind: the letter-quality dot-matrix printer, which combines the advantages of dot-matrix tech-

nology with the print quality of the daisy-wheel. One good example is Texas Instruments' new printer, the Model 855.

The Model 855 joins a number of other similar printers that have appeared over the past year. Their emergence is the result of improving dot-matrix technology, which is finally being applied to real business needs. (For more on advanced dot-matrix printers see, "A Plentitude of Printers," Volume 2 Number 5.)

Dot-Matrix Technology

Dot-matrix printers work by banging little pins onto the paper through an ink ribbon. The pins move only a fraction of an inch, whereas, in the daisy-wheel print-

ers, the mechanism may rotate up to several inches to bring the desired character into position. Thus, dot-matrix printers are intrinsically simpler, more reliable, and faster. Furthermore, they are not limited to printing only characters; they can generate any shape that can be defined by dots.

There is, of course, a penalty to pay; traditionally the print quality of these machines has been poor. Dot-matrix characters are fuzzy, and if you look closely, you can see the actual dots that make up each character. Some of these dot-matrix machines don't print descenders; they squash letters such as y and j to fit above the baseline.

A solution has always been theoretical-

Model 855 Printer

Texas Instruments, Inc.
12501 Research Blvd., Box 2909
Austin, TX 78769
(800) 527-3500

List Price: \$935, \$995 with tractor feed.

CIRCLE 755 ON READER SERVICE CARD



The TI Model 855 combines some of the best qualities of dot matrix and daisy-wheel printers.



ly possible. If a dot-matrix printer produces small enough dots, places them close enough together, and uses enough of them for each character, it can produce print of any quality—even equal to that of daisy-wheel printers. A letter-quality dot-matrix printer could offer faster printing speeds with a sparser matrix and slower, but still adequate, speeds for "letter-quality" characters. Machines with these capabilities could make daisy-wheel printers seem like dinosaurs.

Texas Instruments is not the first company to figure this out. During the past year Toshiba, Mannesmann-Tally, C-Itch, Okidata, and others have all introduced machines that use similar approaches, and some of them produce excellent print. Epson tried to do something similar with the FX series, though it seems to have opted for speed over quality. But, after several months of watching the high-quality dot-matrix market, and testing several of them, none has impressed me nearly as much as the TI Model 855.

The TI Model 855 sells for \$995 (\$935 without a tractor feed), which puts it in the middle price range for its class. It produces draft-quality print at 150 characters per second, which works out to three or four double-spaced pages a minute. It produces excellent letter-quality print at about one-third of that speed. The TI 855 connects to either a serial or a parallel printer port; both interfaces are built into the printer, so all you need is the right cable (be sure to tell DOS where the printer is connected). The printer's tractor feed mechanism pushes, rather than pulls, paper around the roller, so you can actually use the first line of the first page when you're printing continuous forms—no more wasting a page every time you start to print a job.

Forty-eight Type Styles

The printer can be loaded with three typefaces at once. Daisy-wheel printers can switch typefaces only by changing the printwheel, while the 855 holds its type-

faces in \$40 cartridges about half the size of an audiocassette. It has three slots on the front, into which you can load any three typeface cartridges (from the dozen

or so available). Each typeface actually offers sixteen typefaces. The printer generates draft- or letter-quality print in very wide, 10-pitch, 12-pitch, or very narrow

A Typeface for Every Need

An optional circuit board due this spring from Texas Instruments will allow you to create typefaces in RAM and store them on disks or cartridges.

Need a new image? Why stop at a simple logo? Why not create an entire, unique typeface, that no one else in the world uses?

This possibility—a typeface for every need or one unique to every company, becomes possible when typefaces are implemented in memory, as they are on the TI Model 855.

Consider the little print modules that contain the typefaces for the TI Model 855 are simply 8K of ROM. What's in the ROM is plain ordinary data—bytes of ones and zeros. The data that represents typefaces is actually a table of equivalents, which tells the printer what action it should take (what pins it should fire when) in response to ASCII characters sent to the printer by the computer. Changing typefaces means merely changing these equivalents—hitting the paper with a different set of pins, representing a different graphic representation of each ASCII character sent by the computer.

If this table can be put into a ROM cartridge, then there's no technical reason why it couldn't reside in the printer's RAM. There's no reason it couldn't be stored on a disk on the host computer. There's no reason why the table couldn't be created by software in the host computer.

This spring TI plans to release an optional circuit board for the Model 855 that should make this concept of down-

loaded character sets a reality. The board includes 8K of RAM, and you can load it with the equivalence table that represents a typeface, then tell the printer to look into its RAM, rather than into one of the ROM modules, for the information it needs to create characters.

This printer feature should be supported by software that allows you to create the equivalence tables. A grid on your screen will represent a blow-up of the dot matrix the printer is capable of producing. For each of the ASCII characters you might want to print, you'll be asked to indicate which of the squares in the grid should be printed. The software will translate your equivalences (ASCII character to dots in the grid) into the equivalences the printer requires (ASCII character to pin-firing sequence), and create an equivalence table just like the ones that reside in the little typeface cartridges. Once created, the equivalence table can be saved on a disk, to be downloaded to the printer before printing anything.

That means you can create a typeface and transfer it on disk to another user. If the market develops, new typefaces will be available on disk, rather than in ROM cartridge form. Someone really enterprising could buy a ROM burner, create a typeface using software, and load it into ROM cartridges to sell to Model 855 owners who don't have the optional circuit boards. —J.H.

TI MODEL 855

characters, in either boldface or standard print. (Unfortunately, italics and superscript/subscript characters are not available automatically with every typeface cartridge. You have to buy separate cartridges to get these.) Because you can load up to three cartridges at a time, you have a choice of 48 different type styles at one time!

You control printer features either by sending appropriate control codes from the computer to the printer, or by pressing buttons on the printer itself. The Model 855 printer responds to two different sets of control codes, which TI calls WP mode and DP mode codes. (The WP code set is copied from the Diablo printer family, the DP set from the Epson family of printers.) Thus, if your software works with either of these printer families, it will work with the TI Model 855 with very little modification.

Controlling Printer Features

Many users prefer software control of printer features, and, indeed, this method offers the user a wider range of capabilities. However, some of the more obscure features are buried deeply in the manual. How many *WordStar* users, for instance, have figured out how to get condensed type into a document?

Although all of the Model 855's features can be controlled from the computer using software codes, TI had the good sense to put buttons on the printer to control the most common features. You can select the character spacing, draft- or letter-quality printing, typeface module, lines per inch, and single or double spacing. When you're ready to print, you can choose a fast, double-spaced draft or a high-quality single-spaced final copy simply by pressing the appropriate buttons on the printer.

The TI Model 855 also has a graphics mode. In this mode, it acts just like an Epson/IBM printer, so any software that works with the Epson ought to work with the TI. I tested it with a couple of programs and didn't discover any problem.

The Model 855 has 256 bytes of internal memory, which works like a printer buffer, so your computer can stay a couple of lines ahead of the printer. To increase this buffer space, you can add up to 4K to the printer.

Not Perfect, But Close

The Model 855 has a couple of drawbacks. It's fairly noisy, but it's not as bad

Why should you pretend that your several-thousand-dollar PC is actually a few-hundred-dollar typewriter?

as most daisy-wheel printers. The ribbon cartridges are a TI standard, so other brands won't work. The printhead, which TI claims will last for 100 million characters (or something like 3 years at 50 pages

per day), isn't easily replaced. (The new head costs \$50, and replacing it requires a special tool, so you'll want to have a dealer do it.) And TI doesn't offer a sheet feeder for the Model 855, so you might not find the printer very efficient for printing letters on letterhead. But these complaints are minor compared with the advantages this printer offers.

Flexible, inexpensive, well-designed printers like the Texas Instruments 855 are changing our ideas about how business documents should look. Who says the quality of your letters should be defined by what a typewriter can do? Why should you pretend that your several-thousand-dollar PC is actually a few-hundred-dollar typewriter? Shouldn't computer users be creating a new standard here? Perhaps the new standard might dictate that a document is not "letter quality" unless it includes at least four different typefaces? Or what about the idea that every corporation should have its own private typeface? Notions like these may redefine the term *letter quality*, and daisy-wheel printers will truly become dinosaurs. ■

The TI 855 Printer

You can drop **boldface** print, or underline words, anywhere. Printing can be 10-pitch

or at 12 pitch, like this line, to fit more on a page. If you want to print wide financial reports,

there's tiny print. You can fit a lot on a line when it's this little.

This is draft quality print, which is about three times as fast as the fancy stuff. Draft quality includes all the options that are available in letter quality, like **boldface** and underlining.

Letter-quality and draft-quality print samples, showing some of the different ways to print a single typeface.





The Making of Modula-2

Niklaus K. Wirth, the master who brought you Pascal, has distilled the best of 20 years of language writing to create his latest brainchild.

Forecasting is a risky business, particularly in the computing industry. Soothsayers who focus their crystal balls on Silicon Valley can claim little more success than the palm reader at the circus. But forecast they do, and when it comes to languages, a growing number of firms are casting their lots with Modula-2.

Modula-2 is the Swiss army knife of languages, a universal tool that packs utility, simplicity, and economy in a streamlined case. It distills sensible programming rules into structures that encourage—sometimes even force—a programmer to write code in good style. The lan-

guage offers more than style, though; it surrounds the code with a safety net that catches syntax errors and logic bugs. In other languages such errors would flush the program down the tubes without a hint of what went wrong.

That Modula-2 promotes structured programming, accommodates both high and low-level coding, and relies on only 40 reserved words has certainly contributed to its rapid acceptance. But the language's ongoing success is guaranteed by the unofficial hallmark that accompanies its name. Like Walkman by Sony or Color by Kodak—this language is known as "Modula-2 by Wirth."

A Legacy of Languages

Over the past 20 years the languages authored by Niklaus K. Wirth have achieved the rare status of *lingua francas* of computerdom. His first significant language, PL360, made its debut in 1965. Wirth recalled, "PL360 was actually a by-product of the Algol-W effort. To implement an Algol-W compiler, we had the choice of assembly language or FORTRAN. Neither was very attractive, so I wrote PL360 and implemented it as a tool for Algol-W."

The Algol-W project was actually a joint effort between Wirth and the eminent English computer scientist, Charles Anthony Hoare. Wirth and Hoare collaborated to revise and enhance Algol, one of the first structured languages. Algol (which later came to be known as Algol-60) had drawn a wide following since its introduction in 1960, especially in Europe.

The International Federation For Information Processing (IFIP) had invited Wirth and Hoare to serve on a committee of well-known language experts to develop a successor to Algol-60. After the committee rejected Wirth's proposal, Wirth and Hoare branched off to develop his proposal independently while continuing to serve on the committee.

In 1966, they published a revised description of the language, Algol-W. Algol-W produced effective programs by encouraging the programmer to express a problem explicitly, without unstated presuppositions, and derived its power and flexibility from a unifying simplicity. (Those who have worked with Algol will notice this characteristic in Pascal and Modula-2.)

Meanwhile, the committee continued to meet over a period of 3 years. At each meeting the rough draft of the language grew into a longer and thicker document as the committee members tacked on their favorite features. With each addition, Wirth's disillusionment deepened; the language was mushrooming in complexity. Finally, in 1968, the "long-gestated mon-

ster came to birth," as one committee member put it, and was christened Algol-68.

The disagreements over Algol-68 reinforced Wirth's belief that the creation of a language was best accomplished under the firm intellectual grip of a single, unifying mind. This tenet still guides his work

Modula-2 is the
Swiss army knife of
languages, a
universal tool that
packs utility,
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streamlined case.

today, and he regularly turns down requests to serve on language committees.

While IFIP's committee continued to wrestle with Algol-68, Wirth returned to his native Switzerland after an 8-year absence, motivated by "the feeling that I really ought to have a decent structured language for doing what interests me—writing compilers and systems programs." Drawing on his experience with structured programming, he concocted "a clean language" that embodied "clean concepts for teaching." The result was a language called Pascal, named after the famous French mathematician who developed one of the first calculating machines in 1639.

Pascal was slow in catching on by today's standards. The first Pascal compiler came to life in 1970 on a Control Data Corporation mainframe computer. Wirth practiced what he preached regarding the suitability of a high-level language for systems-level programming—he wrote the compiler in Pascal. By 1977, the Pascal User's Group listed over 100 machine implementations, but most colleges and

universities had yet to offer courses in Pascal, and the selection of textbooks was slim. Within that same year, though, Pascal started scaling the charts when the University of California at San Diego began adapting Pascal systems for any microprocessor on 40 legs.

Even with no commercial backing, Pascal succeeded on its own merits and was put to good use on hardware ranging from the behemoth Cray-1 to the least expensive home computers. Professional programmers, who felt straitjacketed writing software for personal computers in BASIC, flocked to Pascal like writers forsaking typewriters for word processors. Colleges and universities embraced Pascal as the ideal dialect for teaching and illustrating computer logic; its clear and natural expression of algorithms and data structures was a godsend for the classroom. In perhaps the strongest endorsement, the world's largest user of computers drafted Pascal as the basis for one of the most ambitious language projects of all time—the Department of Defense's new language, Ada, traces its lineage to Pascal.

"Pascal exceeded my wildest dreams," Wirth conceded. "I never had really thought about how popular it would be commercially. I had hopes it would find acceptance, particularly the ideas behind it. The fact that Pascal itself has been used so widely—that's a nice surprise."

The Trouble with Pascal

Despite Pascal's popularity, it was far from a panacea. Critics complained that its inability to support separate compilation of modules hindered the development of large programs. They cited the flawed CASE statement, which lacked an ELSE clause. They pointed out that the fixed size of arrays precluded the use of general-purpose math and string libraries. In another vein, FORTRAN and COBOL programmers and assembler coders felt handcuffed by Pascal's compulsory declarations of variables.

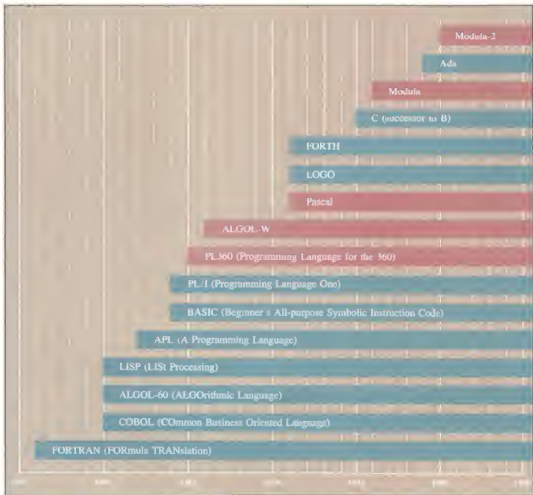
Wirth also recognized Pascal's limitations and agonized over possible remedies. Several times he was asked to head up an effort to update Pascal, but a fresh approach was more in line with his personal philosophy. "If a language proves to be only marginally suitable for some application that was obviously not envis-

aged by its originator," he wrote, "We should muster the courage to build a new, truly adequate tool, instead of just grafting a fix onto the existing one."

The Birth of Modula-2

While universities, software houses, and computer companies were enhancing

Pascal to suit their own needs, Wirth's interests gravitated to multiprogramming, the concurrent execution of several activities. To experiment and express multiprogramming primitives, he contrived a rudimentary language, Modula, which was never intended for wide use. "Modula was never intended to be a language on the



This chart shows the date of first publication of the most popular programming languages. Niklaus Wirth's languages (shown in red horizontal bars) stand out as milestones in computer linguistics.

same level as Pascal," Wirth explained. "It contained primitives for multiprogramming and as few other things as possible. Since writing a compiler is a lot of work, you don't want to carry any extra luggage in the language."

With the insight he had gained while experimenting with Modula, Wirth departed in 1976 for a year at the Xerox Palo Alto Research Center (PARC). There he hobnobbed with the architects of the Xerox Alto prototype computer and studied the Mesa language.

When he left PARC, Wirth worked to merge the bloodlines of Pascal, Modula, and Mesa to produce the Modula-2 language.

In the hardware area, Wirth challenged the industry axiom of writing software to fit existing computer hardware. He reversed this approach and along with Richard Ohran, associate professor at Brigham Young University, designed hardware to fit the new language. Their customized computer consisted of a bit-slice processor optimized for Modula-2, main memory with 128K of 16-bit words, 17-inch raster-scan graphics display terminal with 832-by-640 pixels, three-button mouse, and keyboard.

"The problem of naming the machine has an interesting story behind it," related Ohran, who was in Zurich at the time working with Wirth. "We struggled for a long time trying to figure out a name. Finally, Wirth came in one day and announced that he had decided to call the machine Lilit. I had never heard of Lilit before, but he went on to explain that Lilit was a demon in Jewish mythology, an absolutely beautiful woman, as lovely as God could make her, but she had no soul. According to legend, Lilit comes in the night and seduces men to stay away from their wives and children." Few keyboard thumpers will argue that choice of a name.

Although originally designed for laboratory research, the Lilit is raising eyebrows in the R & D departments of leading computer firms. The Lilit is a "programmer's dream," said Ohran. It offers a

smorgasbord of powerful software tools, including a debugger that splits the screen into eight windows of any size for simul-

Though it doesn't have the backing of a commercial conglomerate, Modula-2 will probably finish strong in the user marathon.

taneous viewing of source code, compiler listing, memory dump, screen image, and chain-of-procedure calls. Diser, Inc., of Orem, Utah, is marketing the Lilit in the commercial sector as "The Modula Computer" for \$22,750. For an extra \$12,000,

the company will throw in a laser printer, cable included.

How does Modula-2 distinguish itself from BASIC, FORTRAN, COBOL, C, and the myriad of other languages that enter the mind of a computer? First, Modula-2 embodies the strengths of Pascal, including compulsory declaration of variables, clear description of data structures and algorithms, and type-checking of data. It offers a syntax that is more systematic than Pascal's, independent compilation of modules, facilities for concurrency, and low-level or assembler-type access to the machine.

Modula-2 does have some shortcomings of its own. One frequently cited problem involves the passing of arrays to procedures. Unlike Pascal, Modula-2 allows open arrays—that is, arrays of unspecified size—to be passed to procedures. The procedure can then determine the extent of the array by executing the standard function, High. This works fine for one-



Niklaus Wirth (left) and Richard Ohran with Lilit, a special-purpose computer they designed to execute the Modula-2 language. Lilit features 832 x 640 pixel graphics, a three-button mouse, and a bit-slice processor optimized for Modula-2.

dimensional arrays, but High only returns one parameter. No provision is made for determining the extent of each dimension of a multidimensional array.

Wirth plans to round out this and a few other rough edges in the third printing of his book, *Programming In Modula-2*, which will be available from Springer-Verlag soon.

As Modula-2 compilers become widely available on various computers, including PCs, the language is just beginning to be put to the test. One of its strong points is that it has the flexibility to adapt to both large and small computers, particularly since it carries no I/O equipment. (I/O has trapped a number of other languages in the past by denying them standardization.) Whether a language that leaves its I/O in machine-dependent modules can achieve true portability remains to be seen. And even though it doesn't have the backing of a commercial or government conglomerate, as C and Ada do, Modula-2 will probably finish strong in the user marathon, since a cadre of Pascal users are sure to crusade behind it.

As it rightfully warrants, language design is receiving increasingly close scrutiny. The stories of space flights gone awry, train crashes, false arrests, and other calamities due to software bugs fill textbooks. In one of the most notorious instances, a Mariner spaceship to Venus was lost because a programmer coded a period instead of a comma in a FORTRAN DO statement. An analogous flawed statement in Modula-2 would never pass compilation. Glenford Myers, commenting on this particular failure in *Software Reliability*, said, "Part of the responsibility for the billion-dollar error falls on the programmer and test personnel, but is not the design of the FORTRAN language also partially to blame?"

Modula-2 has filled many precarious gaps in language design. It's a simple tool that allows the programmer to focus on solving the problem rather than grapple with a cornucopia of operators and strug-

The Maestro of Modula-2

Professor Niklaus Wirth doesn't regard a programming language as a "language" at all.

In November 1982, 20 pioneering computer scientists were initiated into the Computer Industry Hall of Fame. The list of Hall of Famers spanned the industry from head to toe, from Thomas Watson, Sr., the grand-patriarch of IBM, to Bill Gates, the guru of Microsoft, to Steve Jobs, the rootstock of Apple. While the computing community could readily identify most of these innovators with landmark discoveries or corporate entities, one academician stood out for obscurity rather than notoriety.

Niklaus K. Wirth holds no patents in silicon circuitry. He never entrepreneurial a high-tech firm. Instead, his contribution to computing rests in slim scholarly reports brimming with Greek symbols and mathematical notation. Over the past 20 years, these reports have defined no less than five programming languages, and have earned the Swiss professor the title of "Father of Structured Languages."

Ironically, the master of computer linguistics doesn't regard a programming language as a "language" at all. He shies away from the popular notion that a language is a medium of communication between human and machine. Rather, he sees it as an abstract tool for the construction of computing machinery. "In my opinion," said Wirth, "the term *programming language* is ill chosen and misleading. *Program notation* would be eminently more appropriate."

However you define computer lan-

guages, there's no question that Wirth knows them well. The grammars he has designed, published, and implemented are milestones in the field of computer science. Last year, in recognition of these accomplishments, the Institute of Electrical and Electronics Engineers (IEEE) bestowed on him their prestigious Emanuel R. Piore award, and the York University in England and the Institute of Technology in Lousanne, Switzerland, have conferred honorary doctorates. The 50-year-old professor could, in the words of one close associate, "spend all his time globe-trotting around the world collecting kudos," but he prefers the laboratories of the Swiss Federal Institute of Technology (known also as ETH, for Eidgenössische Technische Hochschule) in Zurich where he hammers out the picks, shovels, and hoes of software cultivation.

Reflecting on his early dabbling in electronics, Wirth said, in a nostalgic tone, "Nowadays, most people get a working model of anything by going to the store and buying it. In the past, everyone knew that with a little creativity and effort you could build a better product than those sold in stores. This was a great motivation to do design work. The current trend of relying solely on off-the-shelf products has unfortunate implications for the future of software design, a field in which nothing can replace a creative person's way of thinking."—E.J.

gle through a jungle of inconsistent syntax. In Modula-2, Niklaus Wirth has distilled the best ingredients culled from over 20 years of sampling languages. The Pascal community is laying out the red carpet to welcome this promising new language.

Whether the rest of the computing community joins in the reception as well, only time will tell. ■

Edward Joyce is currently writing a book entitled *Everyone's Guide to Modula-2*.

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A \$40 Invitation to Modula-2

MRI a nonprofit organization, is offering a Modula-2 compiler and utilities for the PC. Its speed of execution and special features provide beefsteak quality for the price of hamburger.

Let's face it. Forty dollars doesn't go far in the computer marketplace. A printer cable, a box of diskettes, a video game or two if you're lucky. So when a compiler for Modula-2, Niklaus Wirth's latest brainchild, goes on the market for \$40, it raises some eyebrows. Is this on the level? Has someone slipped a decimal point?

When I opened the package from Modula Research Institute (MRI), I was eager to sink my teeth into the beefsteak of Modula-2 for the price of hamburger. Other vendors serve Modula-2 for the PC on

M2M-PC, Version 1.33
Modula Research Institute
950 N. University Ave.
Provo, UT 84604
(801) 375-7402

List Price: \$40

Requires: PC-DOS 2.0, 128K RAM, two disk drives recommended.

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sterling silver platters and price it accordingly. M2M-PC weighs in at less than one-tenth the cost of the higher-priced alternatives.

As I started sampling the MRI compiler, the M2M-PC, I was pleasantly surprised by its implementation, relatively

swift execution of code, and extra utility programs. Some imbalances do exist, but MRI's Modula-2 should be a welcome addition to any language connoisseur's diet.

Background

How can a small firm in Utah offer Modula-2 at such a cheap price when the ink is barely dry on the language specification? Before answering this question and delving into the nuts and bolts of M2M-PC, let me first set the scene by establishing a little groundwork on Modula-2.

Modula-2 is to Pascal what the Volkswagen Rabbit was to the Beetle. It corrects flaws, improves performance, and incorporates state-of-the-art engineering. Niklaus Wirth has been refining Modula-2 for 5 years. He even designed a special computer called the Lilith that executes nothing but Modula-2.

By emulating the Lilith environment on

```
(* Eratosthenes Sieve Prime Number Program in Modula-2

Author:      Ed Joyce, with Cliff Zintgraff,
             Keith Stephenson,
             Rick Heller.

Date:        November 29, 1983. *)

MODULE Prime; (* $T-,$R- *)
              (* Turn off index, subrange test ... this is perfect code *)

FROM IoOut IMPORT WriteLn, (* Bring in some I/O *)
                  WriteCard,
                  WriteString;

CONST
  Size = 8190; (* Set up largest possible prime *)

VAR
  Flags : ARRAY [0..Size] OF BOOLEAN; (* Indices integers between
                                       1 & 8191 that are prime. *)
  I,
  K,
  Prime,
  Count,
  Itar : CARDINAL; (* Indices into *)
                  (* Flags array *)
                  (* Prime number *)
                  (* Number of primes found *)
                  (* Counts iterations of main loop *)

BEGIN (* Let's get this show on the road *)

  WriteLn; (* Get ready, *)
  WriteString("10 iterations"); (* Get set, *)
                                (* GO! *)

  FOR Itar := 1 TO 10 DO (* Perform main loop 10 times *)
    Count := 0; (* Initialize prime counter *)

    FOR I := 0 TO Size DO (* Initialize array *)
      Flags[I] := TRUE; (* This isn't a cigarette *)
    END; (* endorsement *)

    FOR I := 0 TO Size DO (* Start the heavy action *)
      IF Flags[I] THEN (* Prime? *)
        Prime := I+1; (* yes *)
        K := I+Prime; (* Index to multiple *)

        WHILE K <= Size DO (* Indicate multiples non-prime *)
          Flags[K] := FALSE; (* Zap that bit *)
          INC(K, Prime); (* Increment to next non-prime *)
        END; (* WHILE *)

        INC(Count); (* Bump the count of primes *)
        END; (* IF *)

      END; (* FOR I *) (* Check next number in array *)

    END; (* FOR Itar *) (* Repeat it for posterity *)

    WriteLn; (* Done--hurry up & display it *)
    WriteCard(Count, 6);
    WriteString(' primes');
  END Prime. (* You can rest now, 8088 *)
```

Figure 1. Sieve of Eratosthenes prime-number generator benchmark program.

the PC. MRI has adapted the Lilith's compiler so that the PC can execute the exact same code.

The Lilith computer executes instructions called M-codes. Then the Lilith compiler translates Modula-2 source files into M-code object files (just as some Pascal compilers translate Pascal source into P-codes).

MRI's product interprets M-codes on the PC, and the compiler and utility programs were transferred from the Lilith in M-code format.

That MRI's compiler was simply borrowed from the Lilith contributes to its budget price. Another factor is that MRI is a nonprofit organization, dedicated to research and development. Having been a member of Wirth's original design team, Richard Ohran, MRI's director, admits that seeking the widespread acceptance of Modula-2 fulfills a personal goal.

Benchmarks

Now that we have the preliminaries out of the way, let's dig into the software. To judge the MRI system against other language products, I ran it through the customary Sieve of Eratosthenes benchmark test (see Figure 1). A second benchmark (see Figure 2) was chosen to put floating point arithmetic through the paces. Benchmark programs were loaded and compiled on one double-sided, double-density disk drive. The results are shown in Figure 3.

Generally, the benchmarks ran fast, especially for an interpreter. The Sieve benchmark clocked in at 167 seconds. Compare this to run times for other languages executing the same algorithm on the PC: M2M-PC is much faster than BASIC (1,950 seconds), but much slower than Softech UCSD Pascal in native mode (20 seconds) and Lattice C (11.3 seconds). Of course, the low times for Pascal and C are largely due to native code generators.

On the floating point benchmark, the speed advantage of the native code languages is less pronounced. M2M-PC tips

the scales at 210 seconds compared to Lattice C at 95 seconds.

Times shown for a third benchmark in Figure 3 illustrate how index and subrange checking influence speed. Modula-2 produces code to check for overflow of variables and indexes by default. For example, in the statement "K := I+Prime" in the Sieve program, the compiler would normally generate code to ensure that the assignment does not exceed the boundaries for a cardinal value; that is, variable K must not become less than zero or greater than 65,535. If the assignment does not fall within these boundaries, the program is terminated with an error message. The range checking was disabled by the compiler directives "\$T-\$R-" in the comment following the MODULE statement in the program. The checks were turned off to allow a fair comparison of languages that do not check range overflow. Benchmark 3 in Figure 3 reflects the results of the Sieve program with range-checking, which increased M2M-PC's execution time about 25 percent and object file size about 4 percent.

In the benchmarks, several routines were "imported" from library modules to perform I/O. These modules are an important adjunct to a language such as Modula-2, which relies exclusively on library routines for I/O. The MRI implementation includes the standard library as defined in Niklaus Wirth's *Programming in Modula-2*; namely, procedures for terminal and file I/O and standard math functions. The math functions include calculation of square roots, exponentiation, natural logarithms, sines, cosines, and inverse tangents.

Utilities

The M2M-PC compiler also includes four utility programs for generating a cross-reference, linking modules into one program, disassembling M-code, and dumping files in ASCII, octal, or hex format. While the utilities generally work, there are some rough edges. For example, using INSPECT, the dump program, is

```
(* Sample benchmark for testing floating point speed of MRI Module-2

Author:      Ed Joyce, with John Tysall.
Date:       Late et night, November 29, 1983. *)

MODULE Float; (* $T-$R- *)
              (* Turn off index, subrange test ... this is perfect code *)

FROM InOut IMPORT WriteLn,              (* Bring in some I/O *)
              WriteString;

CONST
  Con1 = 3.1415927ED;
  Con2 = 1.783903E2;
  Count = 10000;

VAR
  I : [0..Count];                        (* Loop counter *)
  A,
  B,
  C : REAL;                              (* It's the reel thing ... *)

BEGIN                                     (* Let's get this show on the road *)

  WriteLn;
  WriteString("Floating Point Test");    (* Get ready, *)
                                          (* Get set, *)
                                          (* GO! *)

  A := Con1;
  B := Con2;

  FOR I = 0 TO Count DO                  (* Perform main loop many times *)

    C := A * B;
    C := C / A;
    C := A * B;
    C := C / A;

    C := A * B;
    C := C / A;
    C := A * B;
    C := C / A;

    C := A * B;
    C := C / A;
    C := A * B;
    C := C / A;

    C := A * B;
    C := C / A;
    C := A * B;
    C := C / A;

    (* Hope the arithmetic logic unit *)
    (* doesn't start smoking *)

  END; (* FOR I *)

  WriteLn;
  WriteString(' DONE');

END Float.                               (* You can rest now, 8088 *)
```

Figure 2. Floating point benchmark program.

like starting an old car on a cold morning. When the program is invoked it prompts you with the message, Type /help For Assistance. The first thing I did on several occasions was try to type /help. Sometimes that entry was accepted; at other times the slash would not echo and I was refused help. Finally, through random experimenting, I discovered that when the slash was ignored, it would be accepted when I first typed a string without a slash, backspaced over it, and then typed /help. An interesting feature.

When INSPECT does get going it works almost too well. I dumped a 24-line source code file from the MRI distribution disk to the monitor. INSPECT displayed screen after screen after screen—clearly it had missed the end of file mark. At first I thought there was a problem with my PC. But, alas, the software behaved the same way on other PCs as well.

Documentation

While the temperamental utilities can be a nuisance, the documentation is even more annoying. The 70-page, indexless *Module-2 Handbook* is bound to present problems for the programming novices and professionals alike. Eight of the ten chapters are a rough translation of the original German document used by Wirth and his colleagues in Zurich. As it is, it's a sparse, inadequate reference.

In addition to economy, M2M-PC provides features missing from the higher-priced alternatives.

What the documentation *does* tell you can at times lead to anxiety rather than understanding. The chapter on implementation notes, for example, states, "If the diskette is full or almost full, the compiler will hang because it is trying to write to a full diskette." MRI claims that this is a problem in DOS. Sounds fishy to me.

Another mysterious statement in the handbook is: "If COMINT.ABS is not found, the program will search forever in a continuous loop trying to find the file. No error message is displayed." Curiosity got the best of me; I had to try it. Fortunately, the system belied the documentation—rather than looping continually, it displayed the message, "COMINT.ABS not found on default disk. Hit a Ctrl-C and correct the problem." Unfortunately, the PC locks up if you inadvertently touch any other key prior to entering the Ctrl-C combination. Even the ever-trusty Ctrl-Alt-Del

keyboard reset is rendered useless.

Summary

I mention the shortcomings in the utilities and documentation at the risk of not leaving well enough alone. After all, the attractive price of MRI Modula-2 compiler and the general stability of the compiled code certainly override its problems. Moreover, with MRI's concern for quality, the problems may well be corrected by the time this review appears in print.

In addition to economy, M2M-PC provides features missing from the higher-priced alternatives. It's the only Modula-2 compiler for the PC on the market that performs floating-point arithmetic without an 8087 coprocessor. It also supports assembly language interfacing, which is a necessity for meshing code with programs written in other languages.

Richard Ohran of MRI mentioned the possibility of further improvements to the system, including graphics capability, serial I/O support, and an accelerator card for expediting the fetching of M-codes. There are also plans to move more Lilith programs over to the PC. If MRI can incorporate the Lilith's multiwindow symbolic debugger, mouse interface, and other handy tools into M2M-PC while maintaining the \$40 price tag, its product will undoubtedly win the prize as the software bargain of the century. ■

Benchmark	Execution Time	Compilation Time	Compilation Time W/List	Object File Size-Bytes
1. Sieve without index and range checks	167	180	210	308
2. Floating point	210	170	200	344
3. Sieve with index and range checks	205	180	210	320

Figure 3. Results (in seconds) of executing Sieve of Eratosthenes and floating point benchmarks with MRI's M2M-PC. Time spent generating a listing file on the disk is included in the second compilation time.

What's New with Modula-2?

As the newest structured programming language, Modula-2 is taking hold in the computing community. Here are some of its advantages, plus a review of two Modula-2 compilers.

As computer languages go in and out of fashion this year, we'll be hearing some familiar names. Runners-up in the language talent competition include C, LOGO, Smalltalk, perhaps FORTH . . .

Modula-2/86, Version 0.3c

Logitech, Inc.
165 University Ave.
Palo Alto, CA 94301
(415) 326-3885
List Price: \$495
Requires: 170K RAM

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Volition Systems Modula-2 Compiler, Version 0.3

(comes with ASE—Advanced Systems Editor)
Volition Systems
P.O. Box 1236
Del Mar, CA 92014
(619) 481-2286
List Price: \$595
Requires: 64K RAM.

CIRCLE 726 ON READER SERVICE CARD



But Smalltalk seems to have already passed its peak—without many of us having seen it in action. FORTH seems to be fading, too. And, except in schools, it's clear that LOGO's a no go. So it's . . . C. Yes, C again. There seems to be little doubt that C will be this year's language champion. But there is one young contender coming quickly from behind.

Modula-2 is a general-purpose, high-level, computer programming language

that's just beginning to attract widespread attention in the computer community. The increasing interest in this new language should come as no surprise, as it was designed by the Swiss computer scientist Niklaus Wirth, who authored the widely used programming language Pascal.

Although Modula-2's first implementation (on a PDP-11 computer) was completed in 1979, an official technical report detailing its definition was not published until early 1980, and the first public release of a Modula-2 compiler was in 1981. Thus Modula-2 is not yet widely known. Few books mention it, and texts that tell you how to program in it are rare. Modula-2 compilers are just starting to appear; later in this article I'll report on two for the IBM PC. First, though, here are some reasons why Modula-2 will probably be catching on with programmers in months to come.

Structured Programming

Like its predecessors, Pascal and Modula, Modula-2 reflects a particular view of programming: Niklaus Wirth, creator of all three of these languages, is one of an

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important group of computer scientists who have emphasized the principles of structured programming.

The goal of structured programming is to facilitate the writing of bug-free, reliable, and maintainable computer programs by building up large programs from collections of distinct smaller programs, each of which has one entry point and one exit point, and which interact with each other through a small number of clearly identified shared variables.

If you build a large program this way, most of the work is in making sure that the smaller programs work separately. Once you've done that, all that's left is the job of checking the interconnections between these subprograms. If there are only a few of these, you'll be able to complete this task quickly, too. In structured programming, complexity typically increases much faster than program size—if you are successful in modularizing a program, you may find that it takes much less effort to check its separate parts than it would to check a monolithic whole.

When you program in a structured way, you use so-called structured control constructs like IF . . . THEN . . . ELSE and REPEAT . . . UNTIL in designing the logical flow of your program, rather than the branch instructions so common in machine languages or the GOTO construct used in BASIC and FORTRAN. You can easily discern the logical flow of programs with structured control constructs, whereas it's extremely easy to lose your way as you attempt to thread a path through a program that's been woven together with GOTOs.

A language that is suitable for structured programming, then, must start with an appropriate supply of control constructs. It must also permit you to organize programs in terms of smaller units, so-called blocks (almost like building blocks), which share data objects only through explicit (and therefore easily recognizable) paths. In Pascal, procedures and functions are program building blocks; the local variables that are declared

inside a procedure or function are secure from unexpected changes caused by other subprograms. Procedures and functions can exchange data explicitly with each other.

The goal of structured programming is to facilitate the writing of bug-free programs by building up large programs from collections of distinct smaller programs.

er, either by using local variables as calling parameters or by the (not generally recommended) use of global variables.

In programming, you must keep track of the relationships between the data items being processed. A programming language that provides structures to automatically keep track of these relationships will also help you write more reliable software. Structured programming languages should provide you with tools to build rich data structures (such as Records or Arrays in Pascal). By requiring you to declare the data type of each variable you use in a program, the language compiler can provide an extra layer of security for you. It can check that the values you assign to variables are compatible with their types and that the operations you perform on these variables are appropriate.

When Professor Wirth originally designed Pascal in the late 1960s, there were only a few computer languages that were satisfactory for doing structured programming. The venerable programming language Algol, designed by Wirth in the late 1950s, was the first block structured programming language, incorporating many of the control constructs that were later

recognized as vital to structured programming. But Algol's set of data structures was not quite satisfactory.

PL/I and Algol-68, two newer languages, had both been designed with structured programming in mind. Each included a full assortment of structured control constructs and provided a rich set of data types and structures. Unfortunately they were too rich. Both languages were unwieldy, including more constructs than most users could comfortably manage; and writing a reliable compiler for either language was a major undertaking. As a result, neither language was available on many computers.

Wirth designed Pascal specifically as a teaching language, and he deliberately omitted features that could have been included for serious applications programming. Many Pascal programmers simply modified the language to get around its limitations. As most of these changes were somewhat ad hoc, a wide variety of Pascal dialects began to appear. Instead of offering a new standard, Wirth has simply made an end run around the Tower of Babel that Pascal produced and offered a new successor. Modula-2 is built on a Pascal-like base, but it eliminates virtually all of Pascal's major limitations. (For a more detailed comparison of the two languages, see "Modula-2 For Pascal Programmers" in this issue.)

A Standard for Separate Compilation

One of Pascal's most troublesome limitations is its lack of a defined standard regarding facilities for separate compilation. Although Pascal allows you to modularize programs by breaking them up into procedures and functions, it does not permit you to compile these procedures and functions separately from the program that is to contain them. This makes it difficult to test these procedures and functions independently of the program in which they're to be used. Furthermore, each time you want to make a change in a single procedure or function, you have to recom-

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pile the entire program. Finally, this limitation makes it particularly difficult to use Pascal to work on large-scale programming projects. Ideally, programmers collaborating on a project each work on separate modules and combine their work later; but without a manageable approach to separate compilation, programmers are unable to complete their work independently.

The lack of a standard method of separate compilation also makes it more difficult for Pascal programmers to take the "tool kit" approach to programming that has been exploited so successfully by C programmers. The idea here is that you, as a programmer, can write and compile separate procedures and functions to construct a variety of tools for solving the problems that you typically encounter in the programs you write. In effect, when a language permits you to compile procedures and functions separately from program units, you can create a personal, extended version of your programming language with a set of powerful new words that have been custom-fitted to your programming style.

With Modula-2, Wirth uses the module concept to provide a standard for separate compilation. There are three kinds of compilation units in Modula-2: program modules, which are the compilation units of main program segments; and DEFINITION and IMPLEMENTATION modules, which always occur in pairs and are used to compile objects to be made available to other programs. DEFINITION module/IMPLEMENTATION module pairs may include type definitions, constants, variables, procedures, and functions. As a programmer, you get to decide which objects in a module are to be available in other modules—you list them in an EXPORT statement within the DEFINITION module of the pair, and then list them also in an IMPORT list in the module you will use them in (see Figures 1 and 2).

If you've used the UCSD Pascal or p-System, you may notice a similarity

between Modula-2's DEFINITION and IMPLEMENTATION modules and the intrinsic units of UCSD Pascal, with their INTERFACE and IMPLEMENTATION parts. Units are, in fact, the method that the UCSD system uses to add a separate compilation feature to its version of Pascal, and it would not be surprising if, in fact, Wirth was influenced by UCSD's method. There are, however, very significant differences, most notably the fact

that the INTERFACE and IMPLEMENTATION parts of a UCSD unit are always included in a single compilation unit.

Because separate compilation is an intrinsic part of the Modula-2 structure, certain language features that are part of the compiler in Pascal are in Modula-2 treated as separately compiled code and kept in special libraries. As a result, the Modula-2 compiler remains small, while the system itself may be readily adapted to

```
DEFINITION MODULE SuperNumb;

  EXPORT QUALIFIED BigNus,Add,Mult,Div,Sub,REM,QUOT,Overflow,
    Grow,Shrink,PrintNus;

  (* This is the definition module for SuperNumb. A set of *)
  (* Routines for processing Multiprecision Cardinals *)

  CONST NWord = 2;

  TYPE BigNus = ARRAY [0..NWord] OF CARDINAL;

  VAR Overflow,NegResult:BOOLEAN;
      QUOT,REM:BigNus;

  PROCEDURE Grow(y:CARDINAL; VAR x:BigNus);
  PROCEDURE Shrink(VAR x:BigNus):CARDINAL;
  PROCEDURE Init(VAR z:BigNus);
  PROCEDURE Add(VAR x,y,z:BigNus);
  PROCEDURE Comp(VAR x,y:BigNus);
  PROCEDURE Sub(VAR x,y,z:BigNus);

  PROCEDURE Mult(x,y:BigNus; VAR z:BigNus);
  PROCEDURE Div(x,y:BigNus);
  PROCEDURE PrintNus(VAR x:BigNus);

END SuperNumb.
```

Figure 1: A Modula-2 DEFINITION module. Note the EXPORT statement, which identifies those objects in the module SuperNumb that may be imported by other modules or program units. Note that full headers appear for all the procedures, but no code is specified for any. The actual code for the procedures will be included directly under another copy of the procedures' headers in the IMPLEMENTATION module. The DEFINITION module must be compiled before the corresponding IMPLEMENTATION module. Programs and modules that IMPORT objects from the module SuperNumb can be compiled as soon as the DEFINITION module has been compiled. However, you will not be able to execute the compiled code until you've compiled the IMPLEMENTATION module and linked it to the code that will use it.

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differing environments. Incorporating I/O processing in a library module, rather than in the compiler, is similar to what's done in C. Unfortunately, you pay a minor price for this in Modula-2, which you don't have to pay in C: no I/O in Modula-2 is done via generic procedures. This means that there is no single Write procedure that can accept a varying number of parameters of different types each time you call it (or a printf in the case of C). Instead, Modula-2 has several different Write procedures: WriteString writes a string; WriteCard writes a CARDINAL, and so on.

Suffice it to say that Modula-2 is a Pascal-like language that improves upon Pascal in virtually every respect. If you're an experienced Pascal programmer you'll find Modula-2 relatively easy to learn, although it may take a bit of time to get your IMPORT and EXPORT lists straightened out and to get accustomed to the other minor differences in usage.

The Logitech and Volition Compilers

Two Modula-2 compilers now available for the PC are the Modula-2/86 system from Logitech, Inc., which is available to run under PC- or MS-DOS and CP/M-86; and the Volition Systems Modula-2 Compiler, which is sold in a package that includes the UCSD Pascal Operating System, Version 2.0.

Both the Logitech and the Volition Modula-2 Systems provide a compiler and a set of standard libraries. The Volition Systems' compiler includes all of the features of the language as specified by Wirth, with only minor exceptions. It even adds one feature that Wirth plans to include in revisions of the language: function in the Volition version of Modula-2 can return values of any type, including user-defined types. The Volition system also includes support for floating point numbers, but since they require the 8087 chip, I was unable to test it.

The Logitech compiler I reviewed is Version 0.3c. Still in its infancy, this compiler does not yet include support for real

```
IMPLEMENTATION. MODULE RandGen;

FROM SuperNumb IMPORT BigNum,Add,Mult,Div,Sub,REM,QUOT,Overflow,
Grow,Shrink,PrintNum;

(* EXPORT QUALIFIED Rand; *)

VAR Seed,e,c,divisor: CARDINAL;
    SEED,TESTVAL: BigNum;
    A,C,DIVISOR: BigNum;

PROCEDURE Rand(): CARDINAL;

BEGIN
  Mult(A,SEED,SEED);
  Add(SEED,C,SEED);
  Div(SEED,DIVISOR);
  SEED:=REM;
  RETURN Shrink(SEED);
END Rand;

BEGIN
  Seed:=11549;
  e:=16807;
  c:=13469;
  divisor:=32767;
  Grow(e,A);
  Grow(c,C);
  Grow(divisor,DIVISOR);
  Grow(Seed,SEED);
END RandGen.
```

Figure 2: This is the IMPLEMENTATION module for the module RandGen which EXPORTS the random-number generator function Rand(). The EXPORT list is commented out as a reminder of how this module relates to other modules; the actual EXPORT statement is contained in the DEFINITION module. Note the IMPORT list, showing that RandGen imports the multiprecision routines from SuperNumb, the module whose DEFINITION module is shown in Figure 1.

numbers, but Logitech promises such support (again using the 8087) sometime this spring. Owners of Logitech's system will

With Modula-2, Wirth uses the module concept to provide a standard for separate compilation.

receive free software updates through Version 1.0, which will definitely have floating point support.

Attempting to compare these two systems is like comparing apples and oranges. The Logitech compiler produces

machine language code for the 8088, whereas the Volition Systems compiler produces an object program coded to run on a pseudo-machine called the p-machine. Volition's system is built around an emulator program for the p-machine, which interprets the p-machine object code. Since the interpretation process requires processor time, run-times for the Volition system are considerably slower than for the Logitech system.

In the past year it's become a standard test to try the Sieve of Eratosthenes benchmark program on almost any compiler. Although the Sieve program doesn't really test very many compiler features, it does compare how quickly different languages process loops. As expected, the code produced by the Logitech compiler completed this benchmark program appreciably faster (16 seconds) than the code produced on

the Volition system (270 seconds).

It's probably more reasonable to compare the Volition system's code to code produced in other versions of the UCSD p-System than to compare its performance to a fully compiled program. A comparable Pascal program running on the Version 4.0 UCSD p-System distributed by IBM takes about 290 seconds to complete the program's ten iterations, while the same program running on NCI's Version 4.1 UCSD p-System takes about 200 seconds to execute. Another factor to be considered in judging the speed of Volition's p-Code program is that range-checking was on—in a program whose major activity is looping through an array, this imposes a substantial performance penalty. (Range-checking was off on code produced by Logitech's compiler since it hasn't yet been implemented.)

In running a quicksort benchmark program involving extensive recursive program calls, the speed advantage of code produced by the native code compiler was comparable to that of the Sieve benchmark. In file processing benchmarks the native code loses some of its advantage; but if processing speed is a major consideration for you in selecting a compiler, you'll want to purchase the Logitech system.

The price you pay for the Logitech system's speed at executing code is in terms of the time and effort needed to compile your programs. Volition's one-pass compiler works considerably faster than the Logitech four-pass compiler, and you don't have to explicitly link your program libraries when compiling on the Volition system.

In fact, as a development environment, the UCSD operating system you get with Volition's Modula-2 package is considerably better to work in than the environment that comes with the current Logitech system. In the UCSD environment, the compiler stops at each syntax error in your source code and offers you the opportunity to go directly to the editor to correct your mistake. And when you go to the editor

on this UCSD system, you'll be using Volition Systems' excellent full-screen Advanced Systems Editor (ASE), which comes with the Volition package.

If you're an
experienced Pascal
programmer you'll
find Modula-2
relatively easy to
learn.

On the other hand, when you have syntax errors in a program you're compiling on the Logitech system, the compiler continues to run through the second and third passes before it shows an error listing. You must then turn to your manual to look up the numeric error codes, and finally move to the editor to correct your errors. Compiling a 50-line program on the Volition system takes barely 15 seconds, while compiling the same program on the Logitech system takes over 2 minutes.

Because of the Volition system's superior development environment, I'm inclined to recommend that anyone who plans to develop software on the IBM PC in Modula-2 buy either the Volition system only, or both the Logitech and Volition systems. Developing an application with the Logitech Modula-2 compiler is bound to take so much extra time that the savings from using the Volition system's more rapid turnaround and superior development environment will more than pay for the additional expense of purchasing both systems, porting the source code that you've developed on the Volition system to the Logitech system, and making the minor changes necessary to accommodate variations between the two.

The so-called "standard" library packages supplied with the two systems do have some differences, although both claim—with some justice—to be based directly on Wirth's own standard library.

You may have to make some changes if and when you move programs from the one Modula-2 system to the other. Some early releases regarding Modula-2 stressed the portability that would result if a well-defined language standard and consistent standard library extensions were established. It's rumored that Wirth has agreed to develop a firm standard. I hope he does.

Documentation and Support

Both Volition and Logitech include a copy of Professor Wirth's *Programming in Modula-2* (Springer-Verlag, 1983) as part of the compiler package. At this point, Wirth's is the only complete Modula-2 text around, and it's a difficult book. It's certainly direct, and it does have some interesting example programs, but its explanations are bound to leave many of us behind. Volition Systems' manual is written by Richard Gleaves, who is one of the masters of the manual-writing business. It's a delight to read and helps clear up some of the obscure points in Wirth's book. (Gleaves' manual is available separately for \$35.00. It's the best second source that I know of for Modula-2.)

I have had occasion to call on both Logitech and Volition with questions, and I've been impressed by the support I've received from both. The personnel are enthusiastic and knowledgeable. Logitech's policy of giving owners free updates through Version 1.0 is excellent, but it reflects the fact that the product you'll be buying still needs work. Volition's is a more polished product, and, though Volition doesn't offer them free, updates are available at nominal cost.

Both Modula-2 systems under review are worthy, useful, and reliable tools. If you have to choose between them, the Volition system recommends itself based on its superior development environment (and all the goodies it brings, including a Pascal compiler), its compiling speed, and its relative polish; the Logitech system stands out for the potential real speed it brings to your applications. ■

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Modula-2 for Pascal Programmers

The Modula-2 language bears a remarkable resemblance to its predecessor, Pascal. Take a closer look at their differences, though, and you'll see the latter-day luxuries of Modula-2.

More than one Pascal programmer has asked why Niklaus Wirth, creator of Modula-2, didn't name his new brainchild Pascal-2. After all, the languages look so similar that in many cases you need a magnifying glass to distinguish an algorithm coded in Modula-2 from the same one coded in Pascal. The similarities between the Modula-2 and Pascal implementations of the popular Sieve of Eratosthenes program are remarkable (see Figure 1). At first glance, the two listings could be mistaken as identical.

The differences are there, though. Modula-2 is genuinely "new and improved," with about a dozen syntactical differences and three conceptual enhancements. Once you get a handle on these variations, you'll be well on your way to programming in Modula-2.

Several general and syntactical changes



make Modula-2 a sort of "Pascal Deluxe." Here are some of the improvements that put Modula-2 a few steps ahead.

Open arrays—To many of its critics,

Pascal's worst defect is that its arrays are fixed in size, precluding the use of general-purpose math and string-handling routines. Modula-2 solves this problem with the "open array" construct. An open

PASCAL VS. MODULA-2

array is mapped onto the range 0..HIGH where HIGH is the standard procedure that returns the upper bound of its array argument. The following example illustrates an open array. The procedure, FindLen, finds the length in characters of a string of arbitrary size. A space indicates the end of the string.

```
PROCEDURE FindLen
  (InString : ARRAY OF CHAR)
  : CARDINAL;
VAR i : CARDINAL;
BEGIN
  i := 0;
  WHILE (i <=
    HIGH(InString))
    AND (InString[i] <>
      " ")
  DO INC(i);
  END;
  RETURN i;
END FindLen;
```

Flexible declarations—Constants, types, variables, and procedures can be mixed in any order as opposed to Pascal's strict sequence of CONST, TYPE, VAR, and so on. This allows related declarations to be grouped together.

ELSE added to CASE—The CASE statement has been enhanced with an ELSE clause for catching unspecified values. Subranges are also permitted, eliminating the need for explicit declaration of all case values. For example,

```
CASE ch OF
  "0".."9" : HavNumber;
  "A".."Z", "a".."z" :
    HavLetter;
  "+", "-", "*", "/" :
    HavOperat;
  ELSE HavOtherc;
END;
```

Boolean expressions evaluated conditionally—The logical operators, AND and OR, "short-circuit" evaluation of an expression if the result can be determined by the value of the first argument. This allows statements that determine well-defined results even though the second

<pre> MODULE Prime (* Modula-2 source *) FROM InOut IMPORT WriteLn, WriteInt, WriteString; CONST Size = 8190; VAR Flags : ARRAY[0..Size] OF BOOLEAN; i, k, Prime, Count, Iter : INTEGER; BEGIN WriteLn("10 iterations"); WriteString("10 iterations"); FOR Iter := 1 TO 10 DO Count := 0; FOR I := 0 TO Size DO Flags[I] := TRUE END; FOR I := 0 TO Size DO IF Flags[I] THEN Prime := I+1; k := I+Prime; WHILE k <= Size DO Flags[k] := FALSE; k := k + Prime; END; (* WHILE *) Count := Count + 1; IF I = 1 THEN k := I + 1; END; (* IF *) k := I + 1; END; (* FOR I *) END; (* FOR Iter *) WriteInt(Count, 6); WriteString(" primes"); END Prime; </pre>	<pre> PROGRAM Prime (* Pascal source *) CONST Size = 8190; VAR Flags : ARRAY[0..Size] OF BOOLEAN; i, k, Prime, Count, Iter : INTEGER; BEGIN WriteLn('10 iterations'); FOR Iter := 1 TO 10 DO Count := 0; FOR I := 0 TO Size DO Flags[I] := TRUE END; FOR I := 0 TO Size DO IF Flags[I] THEN Prime := I+1; k := I+Prime; WHILE k <= Size DO Flags[k] := FALSE; k := k + Prime; END; (* WHILE *) Count := Count + 1; IF I = 1 THEN k := I + 1; END; (* IF *) k := I + 1; END; (* FOR I *) END; (* FOR Iter *) WriteLn(Count, ' primes'); END; (* Prime *) </pre>
--	--

Figure 1: Side by side, Modula-2 code and Pascal code appear almost identical for the Sieve of Eratosthenes prime-number generator program. Differences are underlined.

operand may be undefined in some cases. Consequently, the statement used in the open array example

```

WHILE ((i <=
HIGH(InString))
AND (InString[i] <> " "))
DO
```

will be legally evaluated even when the value of "i" exceeds the upper array bound: $i > \text{HIGH}(\text{InString})$. This is because the first part of the expression will short-circuit the evaluation, and the second part, which is undefined when "i" exceeds the upper bound, will be bypassed. In Pascal, the expression of this logical statement would require nested IFs.

I/O delegated to library modules—Strictly speaking, Modula-2 contains no

input or output statements. Instead, I/O is delegated to standard library modules to avoid system dependencies. Of particular interest to the Pascal programmer is formatted output of numeric variables. In Pascal, the generic `WRITELN(x)` could be used if x were an integer, real, or string variable. In Modula-2, you would use the library procedures `WriteInt`, `WriteReal`, or `WriteString` depending on the value of x.

Readability enhanced—The structured statement `REPEAT` is terminated by the symbol `UNTIL`, and the structured statements `IF`, `WHILE`, and `FOR` are terminated by the symbol `END`. This eliminates the `BEGIN/END` construct and means less worry about tidying up semicolons.

To further embellish readability, re-

<pre> MODULE Main: (* Modula-2 source *) MODULE RandomNumbers: IMPORT TimeOfDay; EXPORT Random; VAR Seed : INTEGER; PROCEDURE Random : INTEGER; BEGIN Seed := ((Seed * 21) + 13) MOD 256; RETURN Seed; END Random; BEGIN Seed := TimeOfDay; END RandomNumbers; BEGIN (* Main *) WriteInt(Random,3); END Main.</pre>	<pre> PROGRAM Main: (* Pascal source *) VAR Seed : INTEGER; FUNCTION Random : INTEGER; BEGIN Seed := ((Seed * 21) + 13) MOD 256; Random := Seed; END: (* Random *) ... BEGIN (* Main *) Seed := TimeOfDay; WriteLn(Random); END. (* Main *)</pre>
---	--

Figure 2: A random-number generator classically illustrates the module concept. This particular algorithm uses the mixed congruential method to generate a random number between 0 and 255 using the system clock as the seed. In the Modula-2 implementation on the left, the procedure *Random* is visible outside of its module because it is exported. Thus, it can be accessed by module *Main*. The variable *Seed* is initialized from the variable *TimeOfDay* which is imported from another module. Initialization is performed in the outer block of the module. Outer blocks are automatically executed only once—the first time a module is called. Notice that the calling module does not need to supply a seed to the random-number generator.

Contrast this with the Pascal implementation on the right. The seed's declaration floats to the top of the program, causing two problems. Its occurrences become hard to find in long programs, and it becomes accessible to every other procedure when it should be buried safely in *Random*.

served words must be capitalized. Identifiers are case sensitive, too. For example, *Count* is considered distinct from *COUNT*. The use of uppercase characters for reserved words and mixed uppercase and lowercase for programmer identifiers significantly improves the "pretty printing" of source code.

FOR augmented—The FOR statement has been strengthened with the addition of an optional BY part for step values other than 1, such as FOR *i* := 80 TO 20 BY -2. In another change, Pascal's DOWNTO clause is missing. Modula-2 uses step values of -1 to accomplish the same thing.

Better control transfers—RETURN and EXIT statements transfer control from procedures and looping structures. Also, HALT terminates a program.

CARDINAL type—In addition to the standard data types INTEGER, REAL, CHAR, and BOOLEAN, the type CARDINAL has been added for unsigned integer operations.

INC and DEC procedures—Two standard procedures—increment and decrement—streamline common arithmetic operations.

Long identifiers—All characters in a Modula-2 identifier are significant, not just the first eight, allowing the use of long identifiers without worrying about assigning accidental aliases.

Constant restrictions relaxed—Constant expressions may be used wherever constants are expected. For example, the line of code *Flags := ARRAY[1..(1024*2)] OF INTEGER* defines an array with 2048 integer elements. Numeric constants also

may be specified as decimal, octal, or hexadecimal values.

Major Enhancements

Three major enhancements extend Modula-2's capabilities even further:

Modules—Modules are the most important feature distinguishing Modula-2 from Pascal. Modules are the foundation upon which the language may be extended for special-purpose applications. While Pascal depends upon built-in extensions, Modula-2 relegates I/O, system parameters, and commonly used routines to modules in libraries.

The listing in Figure 2 demonstrates the essence of modularity through a simple example, a random-number generator. The module structure isolates its contents from the surrounding program. All communication to other modules occurs through the imported and exported identifiers. In the random-number generator, *Random* can be called from outside the module because it is exported. The variable *Seed*, however, can be accessed only by the *Random* function.

Two other main attributes of modules are separate compilation and run-time binding. Routines may be separately compiled and placed in library modules. When a program that refers to a library module is compiled, the compiler performs complete type-checking to verify the data compatibility of interface between modules.

Run-time binding means that coupled object modules are "linked" at the time the program was run instead of immediately following compilation. Thus, large programs with several modules need not be relinked if a modification is made to one module.

Machine-level access—Modula-2 was designed for programming all parts of a system ranging from I/O drivers to applications programs. It provides facilities for calculating addresses, accessing peripheral device registers residing at fixed memory locations, and determining the internal representation of variables and types. Modules obtain these facilities from

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PASCAL VS. MODULA-2

the standard module SYSTEM.

SYSTEM contains the system-dependent types WORD and ADDRESS, and the functions SIZE, TSIZE, and ADR. Type WORD represents an individually accessible cell of memory. Type ADDRESS is compatible with CARDINAL (positive integers) and can be used in arithmetic operations. Function ADR determines the storage address of a variable. Functions SIZE and TSIZE return the size of variables and types. For example:

```
MODULE Sample;
FROM SYSTEM IMPORT ADDRESS,
SIZE, ADR;
VAR
  TextLine: ARRAY[0..79]
    OF CHAR;
  BytesInLine: CARDINAL;
  BegAddr, EndAddr:
    ADDRESS;

BEGIN
  BytesInLine :=
    SIZE(TextLine);
  BegAddr :=
    ADR(TextLine[0]);
  EndAddr :=
    ADR(TextLine[79]);
END Sample.
```

This sample module calculates the size in bytes of array TextLine and the beginning and ending address of the array.

Coroutines—Modula-2 offers a simple method of modeling multiprogramming events with coroutine procedures. Coroutines are procedures that execute independently, but not simultaneously, providing the capability to service interrupts, schedule processes, and perform quasi-concurrent operations.

A Worthy Successor

Modula-2 solves Pascal's problems with a handful of simple concepts as opposed to a plethora of extensions. It corrects flaws without sacrificing Pascal's most desirable features. Pascal connoisseurs will recognize in the new language the natural expression, rich datatypes, and elegant structure of its predecessor. ■

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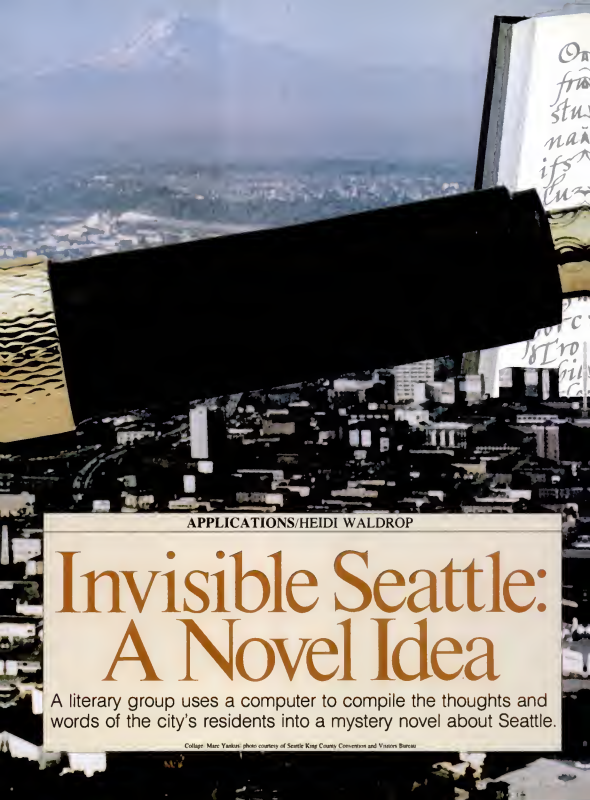
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Invisible Seattle: A Novel Idea

A literary group uses a computer to compile the thoughts and words of the city's residents into a mystery novel about Seattle.

Collage: Marc Yanitzi; photo: courtesy of Seattle King County Convention and Visitors Bureau

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At a booth at the annual Bumbershoot Arts Festival, in Seattle, Washington, sits a TV-like box with a big red button. If the casual passerby finds himself curious and succumbs to the temptation and pushes the button, a voice will beckon him farther into the room. "Now the excitement begins," the voice invites. "We have a room full of computers, printers, copiers, CRTs, pens, pencils, and billboards. Join us in writing the first computer-compiled novel written by Seattle about Seattle. Yes, written by you and your friends. Step inside and take a look. You are on your way to becoming a great author."

Literary Project

This endeavor, called the Literary Computer Project, was organized by Invisible Seattle, a group of about 50 writers and artists that has combined its creative skills with computers. The group discarded the traditional notion of the individual writer struggling for inspiration and decided to use computers to create a mystery novel, also called *Invisible Seattle*. The novel is a compilation of the words and writing of various residents of Seattle. The group used Eagle PCs, which were donated to the effort, and also had access to a mainframe computer at the University of Washington.

The decision to "build a novel" through public participation was conscious on the part of Invisible Seattle. "We could have approached the project in a number of ways, such as having the group sit around a computer and randomly contribute segments of the story," explains Phillip Wohlstetter, leader of the group. "The project would have been interesting, but not nearly as much fun as gathering the information from people around the city and then composing the novel on a computer. Our approach makes the writing of a novel a public event. We created a kind of momentum in the month and a half before the actual writing began. The entire city became aware that it was writing a novel about itself.



The facade of the booth at the Bumbershoot Arts Festival, where *Invisible Seattle* was written.

The actual writing of *Invisible Seattle* took place at the Bumbershoot Arts Festival, but before the writing could begin, the literary group developed a basic outline and created a database of information drawn from the people in the city.

To do this, the group's workers took to the streets, dressed in overalls with words taken from the book's prologue stenciled on them. They wore hard hats with question marks drawn on them. Businessmen were stopped on the street and asked to donate their favorite lie to a section called the Book of Lies (a clue to the mystery). Local bar patrons were asked to fill in the blanks of the song the main character would hear throughout the book. "We had the people of Seattle give us their words. We provided a game element, and the city itself provided the richness of expression and many eyes that saw the city in different ways," said Wohlstetter.

Workers played on the idea of assembly and construction and approached people with phrases such as, "We're Invisible Seattle Contractors—you write it, we build it," or "We build novels the way they used to build cathedrals, block by block, word by word, with a huge labor force and in public." With a carnival atmosphere, the workers scoured the streets, stores, plazas, and cafes of Seattle to find the words, humor, and touching

anecdotes that would fill the novel.

As the actual days of assembly drew near, Ted Holtzman, a computer consultant at the University of Washington, joined the group to design the computer system that would compile and sort through all the information and handle the word processing task. "We had only a couple of weeks to get all the information onto the diskettes as fast as possible," said Holtzman. Fortunately, he had a DEC 10 mainframe available at the university, which provided a greater number of input terminals. "Ideally, we would have liked to use the micros for the entire task, but we had so little time to enter the information, and we had only two Eagle PCs. We entered it all into the DEC 10, and I figured out a way to down load it to the micros. We had it producing about 50,000 bytes of information by the weekend of the festival."

On their next project the group plans to use IBM PCs for the entire job. "We won't be under as much pressure next time," says Wohlstetter. "We'd like to use the IBM PC because it has unofficially been chosen as the standard. It is the quality machine that writers should use. Its possibilities are endless because there are so many people working on new applications for the PC."

Holtzman used the communications program *Crossstalk* to connect the two microcomputers. One gains access to the database while the other is used to write the text with the text editing program, *Spellbinder* (Eaglewriter). He also wrote some of his own text processing programs to convert the text from the mainframe to micro format, and back again.

Scheherazade II

At the festival, inside the space-age box, which the group named Scheherazade II, sit two writers, each at an Eagle PC. While one of the participants is actually writing a chapter of the novel, the other person is searching through the database for the right sections of text or calling out over a loudspeaker for a particular piece of

needed information. When the needed sentence or paragraph was found, the whole room knew it. "I built a small controller computer on top of Scheherazade II," explained group member Clair Colquitt, a video game and children's ride artist by profession. "When a major idea came across, or we were using a large portion of someone's text, the writer would push the button and lights would start flashing, bells ringing, the popcorn popper popping and the toaster making toast. It was a great atmosphere, with a humorous touch," he said.

Each writer was given several guidelines to help write his chapter. He was assigned to write the first draft of the chapter in about 2 hours. The formula used was unique: 15c=8tx2hvoer4 (fifteen chapters of approximately eight typed pages each, written in 2 hours, spread over four days). The tools provided included the data files of word-for-word material (such as overheard conversations, favorite lies from the Book of Lies, time of day file, song, and car files); and the reference files (locations for action, ways of disappearing) which appeared on the auxiliary read-out screen; the list of instructions for each chapter, which provided the framework for the plot and continuity (that is, mention the photo clue, have character A from Chapter 3 appear again, and so forth). In addition they included a map plotting the movements of characters, other maps, books of local history, bus schedules and photographs, and hard copy references from a style file, which contained sample sentence structures, sample narrative meditations, and sample conversation matrixes, and plot subprograms for determining plots by chapter.

Although the group members wrote most of the novel, passersby also sat down at the computers to write. The input stations were designed for hackers and computerphobics alike. Eight-track tape loops inside the terminals that gave instructions to the user. When you pushed the button, a recorded explanation would prompt you for more information. This easy-to-use

The Prologue to Invisible Seattle

The prologue sets the stage for a detective story where you are the main character.

The prologue was assembled by collecting dialogue in the streets from passersby who were asked, "What building is this?" and "What goes on inside?" The names were also collected specifically for this occasion.

Seattle, at first glance, is just another American city. Its buildings sit on land that is bought and sold freely. Its streets conduct people to work in the morning and home again at night, giving them no reason to linger. But there is a second city, an "Invisible Seattle," forever taking shape in the fissures and margins of the "visible" city of skyscrapers, donuts, and boredom. Somewhere in this Invisible Seattle lies the answer to the riddle you have been sent to resolve.

Exactly 1 week ago, your predecessor checked into the very same hotel from

which you survey the morning skyline. He made certain inquiries. He kept a diary. He was seen on the waterfront, in the marketplace, at the stadium. On the fourth day, he disappeared without a trace. Your job is to find him—that much is clear—But how? All you have to go on are the objects found in his room. This room. These objects: a photograph, a diary, a list with 14 names, a fragment of a map, and *The Book of Lies*. Soon you will review the evidence once again (surely it will all add up to something). For now, there is the city.

What Were You Doing at 4:10 a.m.?

- Restlessly sleeping
- Babysitting niece
- Being a security guard at Center Flag Pavilion
- Coming down from evening's festivities, getting ready for the sunrise
- Stumbling out of tent for watch
- Eating a snack
- Getting up to go to the bathroom and getting a glass of water
- At home, asleep in bed
- Sleeping, dreaming, snoring in my Capitol Hill home
- Beginning morning meditation in meditation room at home
- Checking through dumpsters, looking for clues

A sample listing from a database that was incorporated in the novel *Invisible Seattle*. Residents were asked what they were doing at 4:10 a.m.

SEATTLE

system encouraged passersby to participate; people are more likely to contribute when they aren't afraid of the computer.

Structured Inspiration

The framework of the next project, a novel about America, will be similar to *Invisible Seattle*, with more advance planning. The actual writing is being done at the festival. "This time the project will use PCs, and there will be 16 entry stations," said Wohlstetter. "We'll have eight telephone lines hooked by modem from around the country. At the event there will be four keyboards for input and

four for the writers."

Several plots are being considered, but the group plans to see how things evolve. "We'll leave messages on computer bulletin boards, with an explanation of what we want," said Wohlstetter. "Then as our characters progress from state to state, we hope people will call in to describe their area."

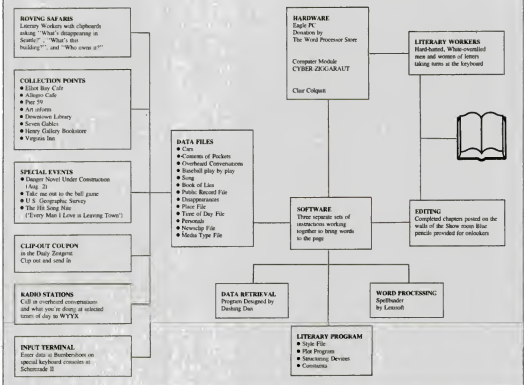
Wohlstetter plans to continue this project, which he describes as "the structured inspiration between man and computer." "In *Invisible Seattle* we found everyone shared a belief of what the city could be, their own invisible image," he

explains, "not the city you see in skyscrapers but the personal, real city. This city is continually being reinvented, and our book was a process of uncovering those dreams." There is an invisible America out there—a heartland of stories and wit to be tapped. And Wohlstetter and his group plan to use the PC to find it. ■

Editor's Note: Invisible Seattle is currently being considered for publication by several book publishers.

Heidi Waldrop is a free-lance writer based in New York City.

Invisible Seattle Literary Computer Project



A diagram explaining the various parts of the Invisible Seattle Literary Computer Project.

The First Heartbeat

Like a newborn baby, a PC is very impressionable from the moment you turn it on. Modifying the bootstrap loader with DEBUG, BIGMEM, and BOOTMEM puts you in control.

Most PC users take it for granted that switching on the power with an IBM PC-DOS disk in drive A loads DOS and invokes AUTOEXEC.BAT. However, reading a disk file is just one thing the PC does in its first moment of activity. Under the PC's simple and impassive cover, a rather complex procedure occurs in the brief span of a heartbeat. The details may vary depending on the level of the BIOS system residing in ROM on a particular system board, but the general process always remains the same.

Switching on the power causes a "hard" reset. The 8088 processor chip is reset, immediately executing the instruction at hex address FFFF0. This instruction always resides in ROM, and it jumps directly to the power-on diagnostic tests. Among other things, the diagnostic routines test basic system functions and all memory locations, finally writing zeroes into all read-write memory locations.

On the other hand, pressing the Ctrl-Alt-Del key combination produces a "soft" reset. It does not actually reset the 8088 chip, and it bypasses the power-on diagnostic tests. Some programs can intercept the Ctrl-Alt-Del key combination and change or add to the standard soft reset sequence.

Both hard and soft resets eventually try to load a program from disk drive A. This operation is called "bootstrap loading," or simply "booting the system." (These terms derive from the fact that the system brings itself into being through its own actions, almost literally lifting itself up by its own bootstraps.) Booting may also be initiated by issuing the instruction INT 19H, provided the effect of this interrupt has not been modified by a user-provided routine.

The bootstrap initiation sequence itself is very simple. First, the system configuration switches are tested for disk attachment. If there is no disk drive, then ROM

BASIC is entered immediately. Otherwise, the contents of track 0 sector 1 of the disk in drive A are read into memory starting at address 31744 (7C00 hex). If there is no disk in drive A, then ROM BASIC is entered (in the PC) or the contents of hard disk track 0 sector 1 are read into address 31744 (in the PC-XT). Finally, the sequence jumps to address 31744, and whatever was read from that one sector becomes the temporary operating system, which remains in full control for as long as it is needed.

Track 0 sector 1 is initialized by the FORMAT command to contain the standard PC-DOS loader, but, "It ain't necessarily so!" The knowledgeable user is free to change the instructions in that sector, whatever is appropriate to a particular installation or application.

"Now," one might ask, "why on earth would anyone want to do anything at boot time other than load DOS?" Answers to this question range from the obvious (copy

HEARTBEAT

protection, for example) to the not so obvious, and the rest of this article will focus on alternatives to loading DOS at boot time.

Exploring the Bootstrap Loader

DEBUG is one of the most useful programs included in PC-DOS. Among its many applications, this little gem can inspect, alter, or replace any sector of any properly formatted disk. DEBUG is a good way to start modifying the bootstrap loading process.

The DEBUG LOAD, or L command (used with the drive sector sector operands, which specify a particular disk and sector), allows any sector of any disk to be loaded into memory, where it can be inspected via the DUMP or UNASSEMBLE commands.

To find out what is in the standard boot record, bring up DOS normally with the DOS system disk in drive A. If you are using DOS 1.0, type:

```
DEBUG
L 100 0 0 1
U 100 101
D 102 130
U 131 1F8
D 1F9 2FF
```

If you are using DOS 1.1, type:

```
DEBUG
L 100 0 0 1
U 100 102
D 103 126
U 127 21A
D 21B 2FF
```

If you are using DOS 2.00, type:

```
DEBUG
L 100 0 0 1
U 100 102
D 103 12B
U 12C 27D
D 27E 2FF
```

You should be rewarded with a display of the contents of the boot record. Displayed address DS:100 corresponds to actual address 0:7C00 when the boot record is in

```

TITLE BIGMEM Large Memory Initializer
PAGE

CODESEG SEGMENT PARA PUBLIC 'CODE'
ASSUME CS:CODESEG, DS:NOTHING, ES:NOTHING
BIGMEM PROC FAR
    PUSH DS                ; SAVE PROGRAM PREFIX SEGMENT ADDRESS
    XOR AX, AX             ; CLEAR A-REG
    PUSH AX               ; RETURN OFFSET IS ZERO (IF USED)
    MOV DS, AX            ; DATA SEGMENT = ABSOLUTE ZERO
    MOV DX, 05:413H       ; GET CURRENT MEMORY SIZE IN KBYTES
    MOV CL, 6             ; SET SHIFT COUNT
    SHL DX, CL            ; FIND MEMORY SIZE IN PARAGRAPHS
    CLD                  ; DIRECTION = FORWARD

LOOP:
    MOV ES, DX            ; POINT TO NEXT PARAGRAPH
    CMP DH, 160           ; END OF CONTIGUOUS RAM?
    JE DONE              ; ...YES
    XOR DI, 01            ; CLEAR DESTINATION INDEX
    MOV ES:DI, AX         ; STORE ZERO WORD
    MOV AX, ES:DI         ; FETCH SAME WORD BACK
    OR AX, AX             ; TEST STORED VALUE
    JNZ DONE              ; ...NO MORE MEMORY
    MOV CX, 8192          ; 8K WORDS = 16K BYTES
    REP STOSW             ; CLEAR 16K BLOCK OF MEMORY
    ADD OH, 4             ; STEP TO NEXT 16K BLOCK
    JMP SHORT LOOP       ; LOOP TO END OF MEMORY

DONE:
    MOV CL, 6             ; SHIFT COUNT AGAIN
    SHR DX, CL           ; PARAGRAPH ADDRESS TO KBYTES
    CMP DS:413H, 0X      ; HAS ADDITIONAL MEMORY BEEN FOUND?
    JE NULL              ; ...NO, BIGMEM HAS NO EFFECT
    MOV DS:413H, DX      ; STORE UPDATED MEMORY SIZE
    INT 19H              ; RE-BOOT WITH NEW MEMORY SIZE

NULL:
    RET                  ; RETURN TO DOS; DON'T RE-BOOT

BIGMEM ENDP
CODESEG ENDB
END BIGMEM

```

Figure 1: The assembler source code for BIGMEM. This program requires the IBM Macro Assembler.

normal use. Instructions appear in assembly language, while data areas are shown in hexadecimal form and as ASCII characters. To get a hard copy of this information, just repeat the last four commands after pressing the Ctrl-PrtSc key combination (assuming you have a printer attached to your system).

The process can also be reversed. The W command (using the same operands as the L command) puts the contents of memory, beginning at address DS:100, onto the disk in drive A, replacing the boot record on that disk.

Large Memory Customization

Let's alter the bootstrap loader to change the way the PC deals with large amounts of memory. Large memories

offer a number of advantages, but they also present some annoying problems. First, the system board switches can't specify a memory larger than 544K (640K in the PC-XT). Second, some programs will not work with large memories. For example, version 1.1 of VisiCalc hangs when presented with more than 512K. Finally, the power-on diagnostics for 544K require about 2 minutes, which can seem like forever.

To get around these problems, it would be desirable to specify a smaller memory (say, 128K) via the system-board switches and use remaining memory only when actually needed. The question is how to do this in a DOS-compatible fashion.

The program contained in Figure 1 shows one way. BIGMEM starts at the

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current specified memory size (which can be anything you tell it). It goes on to find the *actual* end of contiguous memory via the simple technique of a write-read-compare sequence addressed to the first word of each 16K memory block. The memory size value in low memory is then updated to reflect installed memory.

It is also necessary to initialize the additional memory to proper parity to avoid PARITY CHECK errors. Then, the boot sequence must be initiated to cause DOS to reallocate memory to encompass the larger actual memory space. (Pressing the Alt-Ctrl-Del key combination will not work for this, because that will cause the memory size in low memory to be reset to the value you specified in the system-board switches.)

BIGMEM performs all these chores very nicely. If BIGMEM is the first line of your AUTOEXEC.BAT file, then the program will execute each time you boot

BOOTMEM provides rapid power-on cycling, about 23 seconds compared with about 2 minutes when the system-board switches indicate 544K memory.

DOS, automatically expanding the switch-specified memory space to match the actual memory space.

Installing BIGMEM is easy. Just enter the program as shown, assemble it, and link it. The Linker will produce a "No Stack Segment" error message, which should be ignored. Then, copy BIGMEM.EXE to your system disk and type BIGMEM. You will soon find yourself back in the system boot procedure, but this

time DOS will have access to all available memory, not just that specified by the system-board switches.

Using BIGMEM, there are two things that you should be aware of: First, the system boot procedure must be executed twice (although you won't notice the second execution if BIGMEM is invoked via AUTOEXEC.BAT). This allows DOS to adjust its memory allocation to account for the additional memory found by BIGMEM but not by the system-board switches. Second, BIGMEM requires the IBM Macro Assembler. (If you don't have the IBM Macro Assembler, Figure 2 contains the identical program in hexadecimal code using DEBUG.)

Customizing the Bootstrap Loader

A more elegant solution is to embed BIGMEM into the boot record so that it is automatically executed whenever a particular system is loaded. This can be accomplished by BOOTMEM.

The basic method of BOOTMEM is simple, and it is applicable to other kinds of customization. Versions 1.0 and 1.1 of PC-DOS make the job easy because they have a substantial amount of space available in their boot records. DOS 2.0 adds more functions to the bootstrap loader, so there is less free space. However, all of these loaders include a directory inspection sequence that makes sure that the first two files on the disk are the two DOS system files.

Because BOOTMEM is installed selectively on disks known to contain the DOS system files, the portion of the standard loader that looks for these files may be omitted. The file name comparison constants "ibmbio com0" and "ibmdos com0" may also be omitted. These omissions allow enough room to add the operative portion of BIGMEM—or any other function of similar size.

Installing BOOTMEM is slightly more involved than installing BIGMEM. First, make sure the disk onto which you wish to place BOOTMEM has been formatted

with the /S option. Then, insert your DOS system disk into drive A and type DEBUG.

Now, insert the formatted disk you wish to use as a customized system disk into drive A and type the commands in

```
A>DEBUG BIGMEM.COM
File not found
-E 100 1E
-E 102 33 C0
-E 104 50
-E 105 8E D8
-E 107 8B 16 13 04
-E 10B B1 06
-E 10D D3 E2
-E 10F FC
-E 110 8E C2
-E 112 80 FE A0
-E 115 74 16
-E 117 33 FF
-E 119 26 89 05
-E 11C 26 8B 05
-E 11F 0B C0
-E 121 75 0A
-E 123 B9 00 20
-E 126 F3 AB
-E 128 80 C5 04
-E 12B EB E3
-E 12D B1 06
-E 12F D3 EA
-E 131 39 16 13 04
-E 135 74 06
-E 137 89 16 13 04
-E 13B CD 19
-E 13D CB
-RCX
0000
:13E
-W
-Q
```

Figure 2: If you don't have the IBM Macro Assembler, you can get the identical program by entering the following hexadecimal codes using DEBUG. Type in everything except the DOS A> prompt, the DEBUG "-" prompts at the beginning of each line, the 0000 near the end, and the "File not Found" message that you'll get when you begin.

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Figure 3, 4, or 5, depending on whether you're using DOS 1.0, 1.1, or 2.0.

These commands write a new boot record onto the disk in drive A, and then display the memory size currently known to DOS.

Note the value contained at 0:413. You should see 2 hexadecimal bytes. If you read the second byte first, you will have a four-digit hex value that indicates the number of 1024-byte blocks available in RAM. Now press the Ctrl-Alt-Del key combination. DOS should be reloaded with the full memory capacity available. Again, invoke DEBUG and type the D command shown above. If the system-board switches reflect the amount of memory actually installed, the value will be the same as previously noted; otherwise, it will be larger.

The primary benefit of BOOTMEM is rapid power-on cycling, about 23 seconds compared with about 2 minutes when the system-board switches indicate 544K memory. It also allows you to exploit a physical memory larger than 544K for standard applications using DOS.

Other Possibilities

We have only scratched the surface of the potential of programs like BOOTMEM. Aside from the previously mentioned copy-protection uses, one could alter the booting sequence to modify system configuration parameters (as BOOTMEM does for memory size). One could also provide a default AUTOEXEC.BAT function which may later be augmented with an actual AUTOEXEC.BAT.

Of course, one must bear in mind the space limitations imposed by the single 512-byte sector allocated to the boot record. If additional sectors are used, their use must be reflected in the File Allocation Table (FAT). Consult the DOS manual for more information about disk space allocation and the FAT.

One way to produce a much larger bootstrap loader is to code the loader as a standard .EXE or .COM file, then rewrite BOOTMEM to find the loader's entry in

the directory, read the loader, and jump to it. This technique is particularly well

The primary benefit of BOOTMEM is rapid power-on cycling, about 23 seconds with 544K.

suited to a PC-XT system, where the additional space occupied by a large loader would be negligible compared to the total available space on the hard disk.

Given a bit of imagination, the sky's the limit! During your PC's first heartbeat, you are the absolute master of your system. Where else can you have fun, satisfy your curiosity, and improve your productivity in a single stroke? ■

David McManigal is a senior engineer at IBM in Poughkeepsie, New York. He has 24 years of experience in computer engineering and programming, and he has owned an IBM PC for two years. This article is based on his personal experiences as an IBM PC owner. It does not necessarily reflect or represent the position or opinions of the IBM Corporation.

```
A) DEBUG
-L 100 0 0 1
-E 100 EB 06
-E 100 33 C0 8E D8 8B 16 13 04 B1 06 D3 E2 FC E9 A7 01
-E 118 B1 06 D3 EA 89 16 13 04 EB 0F
-E 2BF 80 FE A0 73 18 8E C2 33 FF 26 89 05 26 8B 05 0B
-E 2CF C0 75 0A B9 00 20 F3 AB 80 C6 04 EB E3 E9 39 FE
-W 100 0 0 1
-D 0:413 414
-Q
```

Figure 3: DEBUG commands to add BOOTMEM to DOS 1.0.

```
A) DEBUG
-L 100 0 0 1
-E 100 EB 06
-E 100 33 C0 8E D8 8B 16 13 04 B1 06 D3 E2 FC E9 A7 01
-E 118 B1 06 D3 EA 89 16 13 04 EB 0F
-E 2BF 80 FE A0 73 18 8E C2 33 FF 26 89 05 26 8B 05 0B
-E 2CF C0 75 0A B9 00 20 F3 AB 80 C6 04 EB E3 E9 39 FE
-W 100 0 0 1
-D 0:413 414
-Q
```

Figure 4: DEBUG commands to add BOOTMEM to DOS 1.1.

```
A) DEBUG
-L 100 0 0 1
-E 20E 1E 33 C0 8E D8 8B 16 13 04 B1 06 D3 E2 FC 80 FE
-E 21E A0 73 18 8E C2 33 FF 26 89 05 26 8B 05 0B C0 75
-E 22E 0A B9 00 20 F3 AB 80 C6 04 EB E3 E9 A3 00
-E 2DF B1 06 D3 EA 89 16 13 04 1F C3
-W 100 0 0 1
-D 0:413 414
-Q
```

Figure 5: DEBUG commands to add BOOTMEM to DOS 2.0.

Fixed Disks Without Fear

If you're used to your floppies, fixed disks may seem formidable. Although they have features that make them an attractive alternative, they have drawbacks you should be aware of as well.

The following material is excerpted from chapter 5 of *DOS Primer for the IBM PC and XT* by Mitchell Waite, John Angermeyer, and Mark Noble of The Waite Group, copyright 1984. Reprinted by permission of New American Library.

The Waite Group is a San Rafael, California-based producer of books on personal computing. The Waite Group has written and produced over 30 titles, including *Unix Primer Plus*, *Graphics Printer for the IBM PC*, *CP/M Primer*, and *Soul of CP/M*.

Mitchell Waite, president and founder of The Waite Group, has coauthored 15 computer titles. John Angermeyer is a software engineer and documentation specialist. Mark Noble is a communications engineer and consultant.

"Fixed disk" is IBM's name for a 10-megabyte storage unit provided as the drive in the right-hand slot of an XT or as an add-on expansion unit for a PC. In the industry, the fixed drive is called a "hard" disk because the storage medium is a solid spinning magnetic coated disk, as opposed to the flexible mylar floppy. IBM prefers

to call it "fixed" instead of "hard" because unlike a floppy diskette, you cannot remove the disk from a fixed drive. It's permanently fixed in place inside the computer, locked away from soiled fingers and smoke-filled rooms that can hurt it. Isn't it a disadvantage not to be able to get the disk out of the drive? To some extent it is. But the rationale that has made this trade-off acceptable goes like this: The fixed disk holds about 10 million bytes of information (more exactly, it holds 10,485,760 bytes). Since a standard PC double-sided floppy only holds about 362 kilobytes, the hard disk contains the equivalent of about 30 floppy disks—definitely more bytes than you can shake a stick at! So in



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exchange for not being able to remove the disk from the computer you get a huge amount of storage space. Fair trade?

A Matter of Time

Yes and no. You can transfer any information on the fixed disk to a floppy disk with the standard COPY utility. Thus distributing files is no problem. Further, you

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can remove all the information on the fixed disk to multiple floppy diskettes with a utility called BACKUP. And you can take the information on the multiple floppies and put it back on the fixed disk with a utility program called RESTORE. That all sounds great, but you pay a price for these back-up and recover processes, namely that the time it takes to back up 30 floppies is not trivial. We did a few experiments and discovered that, depending on the depth of your directories, a backup of about 2 megabytes took over 10 minutes. You could spend half an hour just copying all the files on the hard disk to 30 floppy diskettes.

Why would you need to copy all the information on the fixed disk? Because with a fixed disk you need backup protection. If the PC broke, it could ruin or erase all the information on the fixed disk, and you would literally lose all 10 million bytes. Although the PC is an extremely reliable computer, there is always the outside chance that such a failure could occur. Furthermore, the fixed disk itself could fail, or a defect on the magnetic surface could render your stored information useless. If you are relying so heavily on the fixed disk that loss of the information could be a disaster, you need to perform the backup procedure on a periodic basis.

Another special feature of the fixed disk is its ability to hold several different operating systems at one time. Realizing that users of other IBM PC operating systems, such as CP/M-86 and UCSD p-System, would want to use the fixed disk, IBM designed it so it could use any one of up to four different operating systems. Only one of the four operating systems can be activated at one time and the activation process is not a simple pushbutton operation. Also, only one copy of a particular operating system can be on the fixed disk. Not only that, you can also select how much of the hard disk storage space to set aside for each of the operating systems you wish to use. You can even use non-IBM operating systems. But before you

jump up and down with glee, this caveat: To enable any one of the available operating systems on the fixed disk you must run a special utility program called FDISK. FDISK has a function that flags the particular operating system you wish to use when the system is first powered up. You cannot simply switch between CP/M-86 and PC-DOS with the push of a key, either. You must first run the FDISK program. Additionally, the different operat-

A defect on the magnetic surface could render your stored information useless.

ing systems cannot communicate or even share files. And most scary of all, the FDISK program itself is also used to delete the operating systems, so in non-technical or careless hands it could prove dangerous.

Setup and Partitioning

Whether you buy an XT with a fixed disk or add your own expansion fixed disk to a PC, you will need to perform a basic setup procedure. If your fixed disk has crashed, you may need to perform a basic setup to use the disk again. This setup procedure, which must be performed in addition to the normal formatting that is required to use a disk, is also part of the FDISK program.

If you want to set up the disk for operating systems other than PC-DOS, you'll need to familiarize yourself with the subject of partitioning. We'll cover both setup and partitioning at the end of this article.

So what should you know about the IBM fixed drive? Well, first you need to understand how to use the BACKUP and RESTORE utilities in case you must perform these procedures. Second, you may need to know how to set up the fixed disk

for other operating systems and how to set up a virgin fixed disk for PC-DOS in case yours has crashed. We say *maybe* because this is a tricky job and should probably be left to someone familiar with the PC.

The BACKUP utility is used for backing up one or more files from the fixed disk to floppy diskettes. The BACKUP utility works a lot like the COPY utility except that you can control which files get copied in more sophisticated ways. The basic form of BACKUP is shown in Figure 1. The operation in this example will copy the file contents of the \BUSINESS\LOTUS directory, but not its subdirectories, onto a formatted floppy disk in the A: drive.

If you want to back up the subdirectories as well as the files in the path name you specify, you use the /S option, which will copy all files in the subdirectories of the directory specified in the command. Thus:

```
A>BACKUP BUSINESS\LOTUS A: /S
```

backs up all files and subdirectories.

If you want to back up the entire fixed disk onto floppies you would type

```
A>BACKUP C:\ A: /S
```

This directs the computer to copy all files and all directories at all levels of the directory, sort of like a *.* wildcard in the regular COPY program.

Back It Up

When you actually copy a fixed disk, the BACKUP utility will first request that you insert a previously formatted floppy diskette. It will copy files onto the floppy until the disk is filled. Then it will prompt you to remove that diskette, mark it number 01, and insert the next diskette. This process will repeat until the entire BACKUP you specified is completed. Thus it is necessary to have as many preformatted diskettes as you need on hand before you start the backup procedure. You can use the CHKDSK command to find out the

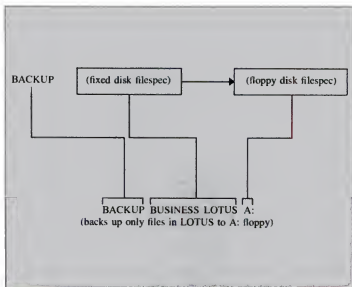


Figure 1: An analysis of the basic form used to back up a fixed disk to a floppy disk.

total amount of bytes you want to back up, or the DIR command, which also calculates file sizes. Then divide this space by 360K to get the total number of diskettes required.

The /M option allows you to specify that only files modified since the last backup should be backed up. This will speed things up considerably since the actual

The format of RESTORE is opposite to that of BACKUP.

number of modified files is probably small compared to the total number of files stored (provided, of course, that you have not waited too long before the last backup). The BACKUP program can automatically tell if a file has been modified since the last backup because there is an indicator in the file. The example below backs up only those files in the PERSONAL

directory and its subdirectories that have been changed since the last time BACKUP was run:

```
A>BACKUP \PERSONAL A: /S/M
```

The /D parameter can be used to back up only those files that were modified after a certain date. For example, say you made your last backup on June 1, 1983. It's now July 1, 1983. If you want only files that were written on or after the specified date, June 1, 1983, you'd enter the following:

```
A>BACKUP \WORDPROC A: /D:
06-01-83
```

This will copy the contents of the WORDPROC directory (you could include /S to get the subdirectories of WORDPROC, too) that have been created or copied to the file since June 1, 1983. If you also wish to back up any files that had been modified at all (not necessarily related to any particular time) you could type:

```
A>BACKUP \WORDPROC A: /D:
06-01-83/S
```

While it's working, BACKUP displays the names of the files it is backing up. If you wish to print a copy of the results you can use the following redirection feature of DOS:

```
BACKUP C:\ A:/M/S >PRN
```

You would use this feature to document the BACKUP procedure. Later this document would serve as a hard copy directory of the contents of the BACKUP floppies.

Batching BACKUP

An interesting feature of the BACKUP utility is that when it's done, the command sets up an "exit" code value of 0 to 4. This code designates that there was normal completion, that no files were found to back up, that the user terminated, or that there was an error and termination. The code can be used by the IF subcommand in a batch file. This means that you can create a batch (.BAT) file that will automatically run any type of backup procedure you desire. The operator can be untrained staff since the batch file will contain instructions for what to do next and reduce the opportunity for error.

Now that you have your files backed up on floppies, how do you get them from the floppies back onto the fixed disk if there is a problem or accidental erasure?

The purpose of the RESTORE utility is to copy one or more files from floppy diskettes to the fixed disk. Note that you can only use RESTORE with diskettes whose files have been placed there with the BACKUP command: files copied with the COPY command won't work.

The format of RESTORE is opposite to that of BACKUP (see Figure 2). Like the BACKUP program, RESTORE has a /S option that tells it to restore all subdirectories of the directory. It also has a /P option that is used to prompt you before restoring files that have changed since they were last backed up, or that are marked read only. You then can choose to restore the file or not. This option will protect you from accidentally replacing the last

FIXED DISKS

modified copy of a file with a previously created older one. Like the BACKUP programs, the RESTORE program sets the ERRORLEVEL flag so that it can also be used with the IF subcommand for automatic batch processing.

Now that you know about RESTORE and BACKUP you will be able to understand the partitioning of the fixed disk.

Divide and Conquer

Earlier we said that the fixed disk could hold several different operating systems at the same time. This feature is made possible by a technique called "partitioning," which simply means dividing the disk up into different areas. Each operating system area occupies a certain number of bytes on the fixed disk. You set up the occupied area through a specially supplied IBM program. The program allows you to divide the 10 megabytes into sections, each dedicated to an operating system you choose. There can be up to four such partitions on the disk. IBM has divided the fixed disk up into what it calls "cylinders." Each of

these cylinders is 32K in length, so there can be up to 305 of them. (The remaining bytes are used up as overhead.) You can specify that all the bytes be consumed by PC-DOS or only a fraction of the total.

The FDISK program is fairly straightforward to use, given a few tips. First,

IBM has divided the fixed disk up into what it calls cylinders, each 32K in length.

IBM calls its main operating system, PC-DOS 2.0, just plain old DOS in the FDISK program. Thus it may be confusing at first to understand its menus. The program allows five options:

- Create a DOS 2 partition. This is the menu item you type if you wish to set up a partition for PC-DOS 2.0. It allows you to use the entire fixed disk for DOS, or only

part of it. You would use all of it if you didn't plan to use another operating system with this computer in the near future. In fact, even if you dedicate all of the fixed disk to PC-DOS, you can later back it up, repartition the disk for a new operating system, then restore the old files within the new smaller partition.

You can create a partition of any size within the limits of 305 cylinders. However, FDISK will only let you create one partition for PC-DOS. If you have no other operating system, then only one partition can be created on your fixed disk. Each version of DOS, UCSD, and CP/M-86 has a FDISK partition program.

- Change the active partition, so you can control which operating system comes up when the system is booted or first turned on. This is a rather cumbersome way to switch operating systems and leads one to think that IBM wanted you to dedicate a computer to each operating system rather than share one computer among several.
- Delete the current PC-DOS partition. This option is used when you want to change the PC-DOS partition to a new size, or if it is damaged and you want to recreate it from the backup diskettes.
- Display the partition data for your inspection. The active/inactive status is displayed along with the type of operating system, starting cylinder, ending cylinder, and size of the partition.

Formatting . . .

After you have partitioned the fixed disk, you still need to format it. In the case of PC-DOS you would use the FORMAT command. This is needed because each operating system uses a different format for storing files. Thus the PC-DOS FORMAT program will not work on CP/M-86, and vice versa. The surface of the fixed disk may contain several different file formats, all of which are incompatible. When you use FORMAT it only puts tracks and sectors on the active partition. After formatting the fixed disk you can use the COPY command to put the desired files on it just as if it were a floppy disk. ■

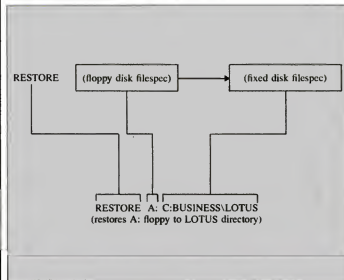


Figure 2: The RESTORE utility actually works like the BACKUP utility, but in reverse.

Taking A Gamble With Word Vision

This flashy new word processing program is decked out like a pack of cards. But you'll find that the stakes in this game are high—one wrong keystroke and you can lose everything.

For the past year or so, wild-eyed savants have been cornering me on the street and sneering, "You can't still be using *WordStar*! *WordVision* blows it away! And it's only \$49.95!" Every time I ran into a *WordVision* user, it was like talking to somebody who'd just seen visions of Nirvana in the bottom of a pickle jar.

WordVision

Bruce and James Program Publishers
4500 Tuller Rd.
Dublin, OH 43017
(614) 766-0110

List Price: \$79.95

Requires: 96K RAM, one disk drive,
80-column display, PC-DOS.

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The *WordVision* folks called these people "pioneers." P. T. Barnum would have used a different name. In a brilliant marketing coup, Bruce and James Program Publishers managed to get people to pay for the privilege of testing the product. The "pioneer edition" did boast one of the most readable manuals I've ever run into. On the other hand, that manual had to admit that, in certain situations, "chances are the program will go 'floopy' and require turning the computer off and back on."

It didn't faze the true believers. "Just

wait," they kept saying, with a smug smile.

Well, *WordVision* has finally arrived for the masses. Is it the Messiah that will lead us out of *WordStar* bondage to the Promised Land? In a word, no. Though it has more than a couple of nifty things going for it, *WordVision* is so quirky and idiosyncratic that it may be your one-way ticket to involuntary servitude.

Stick 'em Up

WordVision is the riverboat gambler of word processors. Dressed up in all sorts of fancy colors, it deals in spades, hearts, diamonds, and clubs. When you buy *WordVision* for \$79.95 (the \$49.95 bargain went the way of most good intentions) you get not only a disk and a man-

ual, but a handy stand-up easel and a whole mess of stickers.

These stickers are not only for all ten function keys, they are also for the entire cursor pad and damned near every gray key on the keyboard. There are, by my count, a full 28 keys with names that don't match the ones on your keyboard. But the stickers don't end there: You get two more to stick on your working copies of the *WordVision* disk so you can tell them apart from your other disks. If this program takes off, you may want to invest in adhesive stock.

An understanding of the stickers is absolutely essential if you're going to comprehend what *WordVision* is all about. The documentation and the program itself both refer to keys that you will see nowhere except on a *WordVision* keyboard. I have them leaned up against my disk drives as a handy reference.

Now, I am not a great believer in decals. I did not install the infamous MicroPro keytops for *WordStar*. And even though *WordVision*'s stickers are almost aesthetic (they show the original IBM logos on the front if you wrap 'em around just right, and the Bruce and James folks assure me that the little beauties will come right off my keys when I'm done with 'em), forget it. I did not pay top dollar for the brilliantly researched, just-rough-enough tactic of the IBM keytops to let foreign stickum gum them up and leave unsightly dirt rings.

Fortunately, *WordVision* offers two alternatives. You can install the program so that the screen displays the usual names of the even-numbered function keys rather than the four playing card suits plus a sunburst that you're supposed to stick over them. Alas, those function keys don't begin to cover the magnitude of the problem. To choose but one example, the PgUp and PgDn keys are Prev and Next in the *WordVision* world, and the program's screens insistently refer to them as such, even though you've told the computer you're the kind of fussybudget who refuses to indulge in decalmania.

The other option is to send 5 bucks to the company for plastic tops that slip over the keys. The company's supplier was late in getting the keytops to an eagerly awaiting world, but the sample I was able to snag seems pretty decent. It fits like a stiff



**Bruce and James
Program Publishers
managed to get
people to pay for
the privilege of
testing the product.**

glove, and the top is a dead ringer for the nubby IBM feel. I wonder, though, if using a bunch of these might cause problems. There's not a whole lot of clearance between the F3 and F4 keys as it is.

We Are in Control

WordVision has taken over the entire keyboard for keeps. You can't use a keyboard enhancer, and you can't do a lot of other things you're used to, either. The advantage is that certain keys work in strange and mysterious ways. For example, if you tap the Alt key, it'll do something, right then and there, without waiting for another keystroke.

A potpourri of onscreen graphics leaves you only 20 lines for your text. The top line includes page, line, and column information, along with a little thermometer-style bar graph that lets you know how far along you are in your text, the amount of memory your text is taking up, and an indication of what the Vision keys (née NumLock and ScrollLock—I'll get to them later) will do. Line 2 displays tab stops and indentation points. Line 23 is always blank (to separate the text from the

next two lines). Lines 24 and 25 inform you what the ever-changing even function keys will do at the moment.

On color monitors, normal text appears on a black background, and the card-sharp keys at the bottom of the screen are decked out in their official keyboard colors: a red club, yellow diamond, green heart, blue spade, and a pinkish sunburst. Boldfaced text is blue and underlining dark yellow to match the keys that control them. Marked text comes up white on blue. Understandably, given *WordVision*'s color-coding scheme, it lacks provisions for customizing screen colors.

Even though *WordVision* displays underlining and boldfacing on the screen, I'm not wild about the monochrome display. It includes a lot of inverse video and—down on the bottom line, right below the most common typing area—high-intensity inverse video, so you always seem to be staring past a bright foreground into a dull mess of background text. You could turn down the contrast to minimize this, but since many of the menus (known here as panels) use high-intensity video to highlight selections, you'd later have to reach for the contrast knob.

Here's a Pointer

WordVision seems to have done a lot of things right. Text reformat automatically onscreen. You can type at the bottom of the screen instead of being forced arbitrarily to work at the top. The screen has no trouble keeping up with text entry. Block operations are generally slick, and you can customize dozens of aspects of the program to suit your whim.

But *WordVision* is absolutely insistent on doing things its own way. It's often stubborn, unyielding, and just plain wrong. The program's insistence on non-conformity will sooner or later cause you grief.

Last time out I discovered a cursorless word processing program: Microsoft's *Word*. *WordVision*'s another. It insists that its cursor is really a pointer, and I

guess it is. It's certainly unlike anything I've ever worked with. The pointer is a little square box that sits halfway up the line, always *between* two characters, never under or over one. It takes some getting used to. You tend to want to delete that extra space beneath the cursor, but it isn't a space, and, for that matter, the cursor isn't a cursor.

As you move the pointer, your text performs all sorts of fast shuffles in order to get out of its way. If you pick the "fast" auto-repeat feature, the pointer can fly like a bat out of hell when you hold down an arrow key. I had to dial back to medium (the default) to avoid repetitive key-strokes.

Would that the deletion keys were as zippy. The backspace key acts destructively, but at the pace of a sadistic snail. To delete to the right of the pointer (the equivalent of "delete at cursor position") you have to use the awkward Shift-backspace combination. Your friendly Del key is no more; it's been assigned the task of switching the capitalization of letters.

And forget about correcting text by typing over it. You can't. The manual touts this as a feature (you can't accidentally type over text you wanted to keep), but as far as I'm concerned, it's an irritating omission. Freed from its usual duties, the Ins key has been assigned the job of transposing the characters to the right and left of the pointer.

Some Key Points

Moving the pointer is reasonable and logical. The four unshifted arrow keys do their usual work: Shift them and they scroll the text in the same direction. The Begin (formerly Home) and End (mirabile dictu, End!) keys take you to the upper left-hand and lower right-hand corners of the screen, respectively. Shift-Begin and Shift-End zip you to the top and bottom of your document. Prev and Next (the erstwhile PgUp and PgDn) take you one screen in either direction; Shift-Prev and Shift-Next take you to the top of the next printed page. That's essential for checking

page breaks, because there's no onscreen page break indicator.

At the heart of *WordVision* are the Vision keys—that's Numlock and Scroll-Lock to you. The Vision keys act as "magnifiers." They do what you last did, but on a bigger area. The left Vision key applies the last action to a word or, shifted, a sentence. The right Vision key applies the previous action to a line or, shifted, a paragraph.

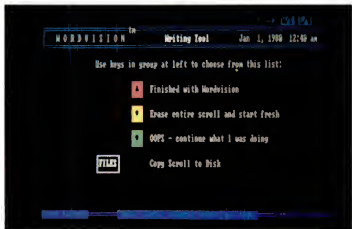
This is an interesting system, but it has its drawbacks. For instance, the Vision keys won't know that you want them to simply move the cursor unless you use an arrow key first. If you use the left (or up) arrow key, the top line of the screen will inform you that the Vision keys will now move the pointer leftward. The right and down arrows turn the Vision keys into rightward pointer movers. But if you delete in either direction, the Vision keys immediately become deletion keys that operate in that direction—and deletion keys they remain until you hit an arrow key or some other key that affects them.

During text entry, what you're likely to do most is delete stuff to the left of the pointer and the Vision keys give you a handy way of doing it. During editing,

though, it's often a pain. When you want to make even the simplest forward deletion, you have to reach for that annoying Shift-backspace combination before you can accomplish a thing. Furthermore, certain operations are counterintuitive. If you delete a sentence to the right of the pointer, the period always remains, requiring another Shift-backspace. And I also have trouble understanding why the apostles of user-friendliness changed the name of these keys to Vision from the utterly accurate labels "Word/Line" and "Sent/Para" in the pioneers' version.

The Undo key (which you formerly knew as the gray minus) is a savior for excesses of Vision. It will restore your most recent deletion letter by letter—if you hit it absolutely immediately after the deletion. Any intervening keystroke will keep Undo from working. If, with a singular lack of vision, you have just deleted a couple of words and then an entire paragraph, the Undo key will bring them back alive letter by letter (or, with the help of the Vision keys, word by word, line by line, and so on). Shift-Undo restores the deletion in one fell swoop.

WordVision has taken over the keyboard so thoroughly that it even makes use



The Final Choices screen appears when you wind up work on a file. One wrong move and you can wipe out all your text.

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of the hitherto orphaned 5 key in the center of the cursor pad. That key in its unshifted state is called Wndw (for window); shifted, it's Mrkr (for marker). Mrkr puts a place marker in your text. When you hit Wndw, a window opens up at the bottom of the screen and displays the first seven lines of text at the marker position. You can't work with the text in the window or scroll it to see more, but when the window is open, you can hit the Find key (F3) to move directly to the marker. The marker then moves to the place you came from so that you can get back again. It's a slick way of moving back and forth between two sections of text, the kind of thing a program like Microsoft's *Word* desperately needs. It'd be even slicker if *WordVision*, like *Word*, let you scroll the bottom window.

Neat Tricks

Another useful *WordVision* touch is the "quick phrase" feature. To store or retrieve phrases (up to five per document), you use the Phrase key (formerly known as Alt0), which shows you the first 13 characters of each phrase beside the function key you must hit to insert each phrase into your text. To change the phrases, you hit the Ctrl/Indent key (otherwise known as Ctrl). As you may imagine, I have one key assigned to the word "WordVision" as I write this article.

In similar fashion, the shifted Phrase key (Shift-Alt), gives you access to special characters not available from the keyboard, ASCII 0-31 and 127-255. You get a selection of five at a time, and you can change which five are available at a given moment by using the Ctrl key. This feature is useful for sending escape sequences to printers and the like.

WordVision lets you perform find and replace operations, but only in the forward direction. It retains previous find and replace strings unless you specifically change them. Search strings can be up to 40 characters long and can include things like carriage returns and tab characters, though you'll have to read the manual to



A *WordVision* directory. The display provides lots of information but doesn't have room to list very many files.



WordVision gives you more options in its Page Appearance screen than you'll ever need but it's nice to have such a wide choice.

find out how to enter some of them. They can also include wildcards for pattern-matching.

You can go out to the Control panel (Shift-Indent takes you there) to select exactly what sort of fancy stuff you'd like to accomplish with your searches and replaces. You can look for whole words only, ignore capitalization, look for matching emphasis, change only material

in marked excerpts, or make the changes match the capitalization in the original find string. To find all the words you've underlined, for example, you could search for the underlined wildcard character (entered with F6 from the find menu). It's a sophisticated set of options, marred only by two misspellings of the word *analogous* on the Control panel.

WordVision's Block operations are un-

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usually powerful. To mark a block (here called an "excerpt"), you simply hit the F6 key to begin excerpting, then move the pointer forward or back through the text, marking it in inverse video. When you're done, you hit the F6 key again to finish marking the block.

To work with an excerpt, you hit F1, the Xcrt key, and a window opens up on the bottom half of the screen. Using the Prev and Next keys, you can flip through the first seven lines of each of the excerpts you've marked to find the one you want. You can delete an excerpt or you can move or copy it to your current cursor position, provided that position isn't within an excerpt.

The whole process strikes me as just about ideal, except that it can be confusing and slow when many blocks are marked. *WordVision* stores them in the order they appear in the document so if you're working with a block near the end of your text, you may have to page through the half dozen blocks ahead of it just to move a word or two. Moral: Unmark your block when you're done with it. Underlining and boldface aren't visible in the marked excerpt itself, but you can see them in the window, which seems reasonable enough.

And though, from the onscreen menus, *WordVision* appears to lack the important ability to write excerpts to a separate disk file, in fact it can. Too bad the method (hit



If you're working
with a block, you
may have to page
through the half
dozen ahead of it.

Files, then Xcrt) is buried deep in the manual.

Shifty Capitalization

WordVision uses the Del key to move the pointer and change the case of each letter it passes. Unshifted, the key works from right to left; shifted, it works left to right. The Vision keys can be used to magnify the effect of this function, and they can be extremely handy for capitalizing a

title or a header. The unshifted Ins key swaps the letter to the right of the pointer with the one to the left. Shifted, it reads the Vision key to swap a word, line, sentence, or paragraph with the next one.

Hit the Diamond key (F4) for underlining or the Spade (F8) for boldfacing, move the pointer in either direction through the section of text you want emphasized, and hit the appropriate function key again to finish the job. Or hit either key and type in text; it will appear with emphasis until you hit the function key again. To underline boldfaced text or vice versa, you simply repeat the process. Incidentally, *WordVision* underlines the spaces between words. If you want naked spaces, you can perform a search-and-replace operation to weed out the underlined ones.

The Adjust key (formerly PrtSc) lets you make vertical and horizontal adjustments to text. The horizontal feature (unshifted Adjust) lets you justify and center text or set it flush right. You can undo the formatting in any section of text by hitting Adjust and Club (F2). To get superscripting or superscripting, hit Shift-Adjust and Heart (F6) or Spade (F8), and move the pointer. The text will appear highlighted to let you know it's been super- or sub-

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scripted—but there's no way to tell which until print time.

Tabs and indentations can be set independently, and they hold up through subsequent changes in page format. The tab line at the top of the screen shows settings



When you set tab stops and indentation points, the entire document adjusts itself to them.

every tenth column, but they're just for reference. Double-line markers below (for tabs) and above (for indentation—for example, temporary left margins) the line indicate the proper points. Decimal tabbing (for aligning columns of numbers) is accomplished by using the combination you're used to thinking of as Shift-Tab. It's a good feature, since it doesn't require you to set special tab markers. You use the Indent key (otherwise known as Ctrl) to indent text; hanging indents can be produced by making sure to avoid indentation until the second line of the paragraph. On the other hand, there's no provision for "local" tabbing. When you set tab stops and indentation points, the entire document adjusts itself to them. If you've got a document with more than one numeric table, you may have to break it up into multiple files.

You adjust page formatting with the help of one of the snappiest screens I've seen in the word processing world. Hitting the Fmat key (F5) and then the Diamond (F4) gets you the Page Appearance panel, which lets you select paper width, length, type size, margins, and text height, and

graphically displays the results of your choices as you change them. Unfortunately, *WordVision* can't get more precise than 1/2-inch increments. If you need column-by-column or line-by-line control of your page layout, you'll have to go elsewhere.

The Page Titles panel lets you enter single-line headers and footers justified left, right, or center, but only 40 columns long at each position. It's your job to keep the positions from overlapping if you want a straight-across header. You can keep the header and footer from printing on the first and/or last pages of a document, but otherwise you'll get it throughout; there's no way to change midway through a document. Headers and footers always appear halfway between the top or bottom of the paper and the top or bottom of the text; there's no way to adjust them.

Spaced Out

Double-spaced text appears that way on the screen. You select it from the Main Control panel, and since it takes place in a trice, you can wait until print time to switch from one spacing mode to the other. Unlike many word processors (*WordStar* being the prime example), *WordVision* recognizes spaces inserted between paragraphs; if you don't want them there when you switch from single to double spacing, you'll have to take them out with a find-and-replace operation. There's no provision for line spacings other than single or double.

Disk operations are yet another area where *WordVision* goes its own way, to its everlasting shame. At first it seems downright luxurious: Filenames can be up to 40 characters long and the file directory displays little "file folder" icons with each file's full name and its date and time of creation. To the terser DOS, the very same files are known as GENERAL.01 through GENERAL.50 and *WordVision* keeps track of them with an additional file called GENERAL.DIR.

The drawbacks? For openers, *WordVision* lets you store only 50 files per disk,

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no matter how long or short those files may be. In addition, *WordVision* stores two characters for every one that appears in your text. Your double-sided disk drive has just been transmogrified into the functional equivalent of a single-sider. Both restrictions mean your disks fill up in a big hurry, and the money you save by buying this "low cost" program may be spent buying extra disks.

The two-for-one file structure fills up memory fast. A 13-page, single-spaced file with margins about 64 columns wide is all you can manage at one time on a 128K machine. If your machine has more RAM, you will be able to take advantage of it—the claim is 8 pages of double-spaced text (that's a generous four single-spaced, folks!) on the minimal 96K machine and 50 (read 25) on a 256K machine. Since *WordVision* and the text

file it's working on must load into memory (except for the program's help screens) and since there's absolutely no provision for linking multiple files, those who "write long" had best stay away.

That Nagging Feeling

If you ask it to, *WordVision* will nag you every minute, hour, or any full-minute interval in between, to save your text. If you prefer, it will even take over the computer and save your text automatically at the prescribed interval. That's terrific. Unfortunately, saving text with *WordVision* is a cumbersome process. From your text, you use the Stop (Esc) key to reach the Final Choices panel. On the bottom line, a message warns you if you haven't saved your most recent editorial changes. But if you miss that message—and you will—you might accidentally

take the Club option (F2), "finished with *WordVision*," and exit to DOS, losing all your changes in the process and impelling you to take a club to the *WordVision* disk and pound it into a pulp.

If you mistakenly choose the Diamond option (F4), "erase Entire Scroll and Start Fresh," it's all over. You do get one last chance—hit the Undo key immediately, and your text will come back. But there's no message to warn you, and it's more likely that you'll type a keystroke or two first, which will spell doom. I devoutly hope the *WordVision* people will add a final prompt for confirmation. If they don't, they'd better start hoping that the fingers of the people who've lost volumes of text are no more accurate on triggers than they are on keyboards.

The correct response at this screen, by the way, is Files (F7), "copy Scroll to Disk." This choice presents you with the *WordVision* file folder directory, beginning with the oldest files first. (Showing you your most recent files makes more sense to me, but not to *WordVision*.) Next, you follow a long-winded and illogical series of responses. First up is Diamond (F4), for "Save to disk." Next, assuming you don't want to change the name of the file, you join the Club (F2). After the save is complete, *WordVision* asks you if you want to kill the last version.

You don't. What if you later decided you wanted to go back to something in the last version? You might want to kill the next-to-last one, but that logical step, automatic with many programs, requires lots of keystrokes here. You therefore end up saving version after version of the same file on your disk. When it fills up, you have to go back and trash the old ones. That's fairly easy; it's just a nuisance.

But the real nuisance comes when you try to back up your files onto a second disk. Normally you might do this at the end of the day, just go out to DOS, check which files you've changed, and copy them from your disk to a backup. Not with *WordVision*, you won't. The manual spe-



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cifically warns against copying any *WordVision* GENERAL file with the DOS COPY command. The only way you can back up individual files to a separate disk is to load the file to be copied into *WordVision*, then swap disks to copy it. The other approved backup method is to use the DOS DISKCOPY function, which is not terribly tolerant of human error and displays an uncanny talent (especially late at night) for wiping out entire disks.

Top Secret

Very late in the manual, you discover *WordVision*'s dark, dirty secret: You cannot use DOS to copy, create, or erase files whose names begin with GENERAL. This restriction implies that you can't send these files via modem to another *WordVision* user—at least not using normal DOS software. As it turns out, you can, but *WordVision* won't be able to find the files unless you read them in with the program's "DOS File Editor" option.

You see, you can use *WordVision* to edit DOS files. From the Main Control panel, you can turn *WordVision* into a "DOS File Editor" instead of a "Writing Tool." The program then saves files in a standard DOS format (and without any character emphasis or fancy formatting) instead of the *WordVision* way. When you're using the DOS file editor option, you don't get to see the full name of your GENERAL files, and you can only assign a DOS-approved filename—the program truncates certain illegal filenames instead of warning you about them. Here *WordVision* does what it should have been doing all along: If you save a file under the previous filename, the program renames the old one .BAK and erases the last .BAK version. Too bad the "writing tool" isn't as smart.

WordVision supports the IBM printer (with and without graphics), the Diablo 630, the NEC 3550, other NEC Spinwriters, "dumb printer," and "very dumb printer." Given all the Okidatas, Qumes, and C. Itohs out there, it's a pretty cheesy selection. I wasn't able to test anything

more than my dumb IDS Prism, which, as I expected, couldn't produce super- or subscribing. Other "dumb" printers probably won't be able to, either. And if you've got a serial printer, you may be in for some trouble; serial printers must use a "hardware handshake" rather than a "software handshake" to work correctly.

Assuming you have an approved printer, printing is simple and straightforward.

At the touch of a suit key, you can print the current screen or the entire scroll, and you can send a form feed to your printer to get it started in the right place. You can also print all the marked excerpts or the file directory (though you may forget how because the choices aren't offered in the menu). There's no provision for simultaneous printing and editing.

(continued)



This is a sample screen in editing mode. Note the color-coding, keyed to the function key assignments at the bottom of the screen.



WordVision's Xcprt operation in action. The excerpted text appears in the window and you can work with it there.

WORDVISION

WordVision offers you more customization options than you'll ever need to use. You can decide what it should remember from the last time you edited a given file: text, quick-phrases, tab rulers, page formats, control panel settings. You can customize the defaults for all those options, and you can also customize the key repeat. You can even adjust the function of the CapsLock key to emulate a typewriter, an ancient instrument on which the lock shifts the numbers to punctuation and is toggled off by an extra tap on the Shift key.

A passel of help menus is accessible at the touch of the Help (gray plus) key. Many of the screens display a representation of the PC keyboard and show you the exact key sequence you should hit for a particular function, but you're not likely to remember it when you return to your text. It's nice to know the help is there, but

since it's not context-specific—it doesn't know what you're working on and interested in at any given moment—I suspect it'll be used about as much as the stuff on *WordStar's* J menus: hardly ever.

On the other hand, the attractive spiral-bound, easel-held manual is laid out well and has a decent index. It's not as chatty as the pioneering original, but it deserves high marks. The droll tutorials work with files on the distribution disk. The only missing item is a quick-reference card. If you're in dire straits, you can call a toll-free hotline number. The people seem genuinely friendly and helpful and didn't even put me on hold.

WordVision is not copy-protected and the master disk is designed solely to create working copies complete with DOS and clock utilities. Well-designed screens step you through the installation process and

trap the worst errors. Even with a two-disk system, a lot of disk-swapping is required, but you'll only be doing this once or twice. Installing the program for an XT is confusing; if you try it, be sure to read the information on page 150 first.

According to the documentation, *WordVision* won't work with certain software spoolers or with *ProKey*. My spooler worked; *ProKey* didn't. There are also various limitations involving DOS 2.0. If you put your *WordVision* files in the root directory, the PATH command will find them. But once *WordVision* starts, you can't access files that aren't in the current directory. A few other oddities are outlined in the manual.

Aside from the odious Vision keys, and a few other features I've come to hate, *WordVision* is easy to learn and relatively easy to use. It's full of handy features that

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WORDVISION

I'm already beginning to wish were available on my own word processor. Cursor movement is fast, and though saving text is on the slow side, neither that function nor any other is below average in speed.

But memory limitations and missing features make *WordVision* utterly inadequate for long documents. And I simply refuse to use a word processor that will let me wipe out my text with one errant keystroke. If you don't lose your text, *WordVision* may decide to hide part of it from you, as I discovered while writing this very review. If you create a long piece of text on a machine with lots of memory and then try to load it on a machine with less, you may discover that the lower-end machine won't let you look at, let alone edit, the final portion of the document.

At least that problem is documented. I also ran into two undocumented program

bugs. One recalcitrant paragraph absolutely refused to reform itself to the new margins I set, and the automatic pagination feature kindly starts off each document

**The automatic
pagination feature
kindly starts off each
document with two
page 1s.**

with two page 1s.

Its goofy file and keyboard structure put *WordVision* in a class by itself. It's clever, all right. Too clever. *WordVision* doesn't obey DOS specifications, which may help performance but it does incur a price: compatibility. As it stands, the pro-

gram won't run on the PCjr, and I bet it won't run with Microsoft's *Windows*, either.

WordVision tacitly assumes you'll never use any other software but the *Vision* line. Need a spelling checker? Too bad. The only one that'll work will have a name that ends in *Vision*, but it isn't available yet. Need more printer support? For a price, you can buy our soon-to-come power packs. But sooner or later you'll want to take advantage of your PC's versatility. You'll start programming in BASIC or using a spreadsheet. You'll pound on the shifted backspace key and nothing will happen. You'll punch a *Vision* key and discover numbers all over your screen.

At that point, you may vow to stick with software that plays by the rules of the IBM world. If not—well, pioneers, welcome to *CalcVision* and *BASICVision*. ■

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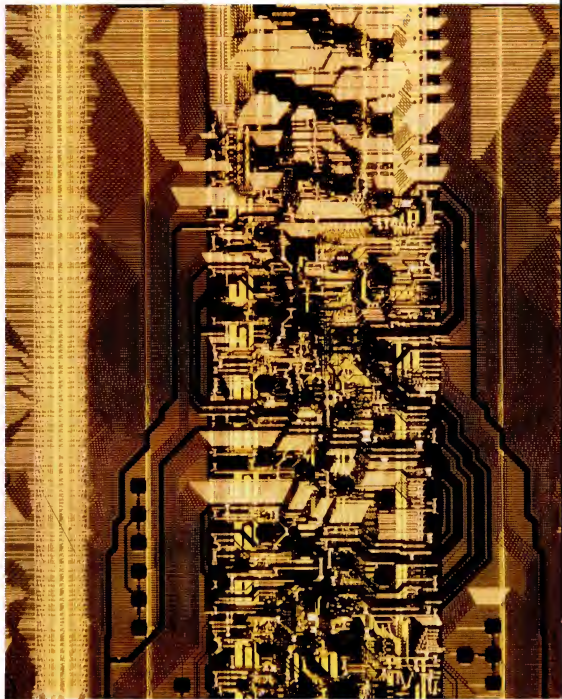
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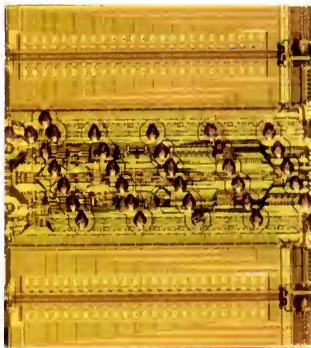
*State of the Art: A Photographic
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Ticknor & Fields, New York, 1983
xvi, 80 pp.; hardcover, \$17.95

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Detail from a photograph of the first 294,912-bit (288K) dynamic RAM, an experimental chip with a huge storage capacity, produced by IBM in 1981.



1977

An Unexpected Breakthrough: The First 65,536-Bit (64K) Dynamic RAM (IBM)

IBM is the world's largest chip-maker, but it's not the most innovative, and its ICs have had considerably less technological impact than the creations of Fairchild, Intel, or Texas Instruments. (Western Electric, the manufacturing arm of the phone company, is the second biggest.) There are two major reasons for this: IBM's chips are used only in its own products, whereas the other firms' ICs are sold on the open market; and, at least in the early years of IC development, IBM lagged behind the IC industry as a whole, being reluctant to adopt this new form of electronics until its ability was fully proved.

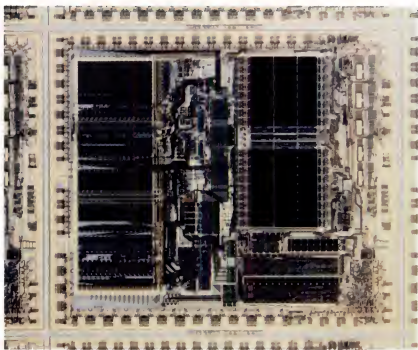
Nevertheless, IBM has made many important innovations in semiconductor technology. At a time, in 1975, when most IC companies were struggling to develop the first 16K RAM . . . , IBM surprised the industry with the creation of an experimental

64K dynamic RAM. Only two years later, it began mass producing it—two to three years ahead of other firms. Although IBM's 64K RAM was the first, the chip was relatively slow and rather large, which reduced production yields, and it used a lot of power. It probably would not have survived on the open market, but it was adequate for IBM's varied purposes.

Because IBM's chips are designed for its own products, they tend to have an unusual architecture. The 64K RAM, which bears little resemblance to the gridded memory chips of other firms, is no exception. IBM chips also contain redundant memory cells—auxiliary cells that can be turned on if other cells are defective, thus rescuing partially broken chips from the junk pile. Pioneered by IBM, redundancy is often employed in the making of high-capacity memory chips.

A bit may be read out of or into this IC in 300 billionths of a second. The round balls in the center are lead-tin connectors and are used as contacts for wires linking the chip to other devices. The four rows of light yellow paddies in the middle of the memory grids on either side of the chip are minuscule fuses that can be blown to shut off defective memory cells and to steer signals to extra cells. At 0.366 x 0.693 inches, this chip is the largest in the book; later IBM 64K RAMs were almost 50 percent smaller.

STATE OF THE ART



1979

One of the Most Powerful 16-Bit Microprocessors: The 68000

(MOTOROLA)

Although the first 16-bit microprocessor, National Semiconductor's PACE . . . , was introduced in 1974, it wasn't until the end of the decade that chipmakers began turning out powerful, general-purpose 16-bit microprocessors. PACE's major drawback was its slowness, the result of its being made out of hole-doped transistors; by contrast, the Motorola chip shown on the right is composed of electron-doped transistors, and for this and other reasons is much faster than PACE.

One of the most versatile and widely used of the 16-bit microprocessors, the 68000 was endowed with intricate internal circuitry that enables it to behave, in many respects, like a 32-bit microprocessor. Although the 68000 absorbs data in 16-bit strings, it can fuse them internally into 32-bit chains, and thereby

process chunks of information twice as large. All things being equal, that feature makes it faster and more potent than other 16-bit ICs; it also makes it competitive with true 32-bit chips (like the Hewlett-Packard IC. . .).

To users of microprocessors, however, 16-bit chips offer many more advantages than simply their ability to process longer strings of numbers than their 4- and 8-bit counterparts. They can also address much larger memories—the 68000, for instance, can control some sixteen million bytes, or 16 megabytes, of information, whereas PACE can supervise no more than 64K bytes. The 68000 has many applications, from industrial control equipment to personal computers. It is used, for example, in the most sophisticated model of the Radio Shack TRS-80.

The 68000, shown here on an uncut wafer next to other 68000 chips, can multiply two 16-bit numbers in a mere 3.2 millionths of a second—fifty to sixty times faster than 8-bit microprocessors like the Intel 8080. . . . Eight-bit microprocessors can multiply only by repeated addition, whereas 16-bit microprocessors can contain circuits that enable them to multiply numbers in only a single operation. Actual size of the 68000: 0.246 x 0.281 inches.

STATE OF THE ART



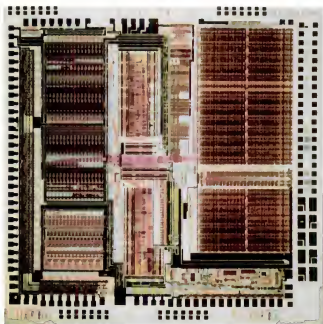
1981

The Cutting Edge of IC Technology: The First 294,912-Bit (288K) Dynamic RAM (IBM)

Few chips are as dazzling as this one, a 288K dynamic RAM that looks less like an IC than a stylized Navajo rug. Because of its enormous storage capacity—it can store the equivalent of some thirty double-spaced 8½-by-11-inch typewritten pages—it is an impressive technical accomplishment. But it is an experimental chip and probably won't wind up in a product—most likely a computer—for several years. Except for Western Electric, very few firms have produced even a 256K RAM, let alone a 288K model.

Despite the chip's extraordinary appearance, it was rather conservatively designed; IBM was less interested in forging new design techniques than in proving that 288K RAMs could be fabricated with existing ones. As a result, this IC is quite slow and uncommonly large—in part because it was made with redundant memory cells that may be turned on if some cells prove defective. Because this IC is bigger than most RAMs, it is more prone to manufacturing flaws; such extra cells saves partially defective chips from the scrap heap.

Like a work of art, this chip has a design all its own. It is made up of four 72K memory grids (the circuits with the crisscrossed features between the gold-colored columns). The irregular elements in the center are amplifiers; the dark balls are lead-tin connectors for wires linking the chip to the outside world. The gold-colored columns contain decoding and amplifying circuits. A bit may be read out of or written into this IC in 450 billionths of a second, only half the speed of other RAMs. The photo's colors were created by bright lights shone onto the chip. Actual size: 0.149 inches x 0.259 inches.



1981

The Fourth Stage in Microprocessor Development: A 32-Bit Microprocessor (HEWLETT-PACKARD)

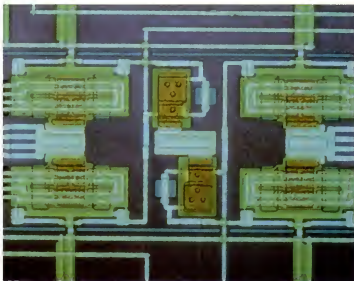
Built out of some 450,000 transistors, and one of the most sophisticated ICs yet produced, this chip is a 32-bit microprocessor. It contains about 9K 38-bit words of ROM and can multiply two 32-bit numbers in 1.8 millionths of a second. This IC represents the fourth stage in the development of microprocessors—a progression that began with the invention of the first 4-bit microprocessor at Intel and Texas Instruments back in the early 1970s . . . and of the first 8-bit and 16-bit devices at Intel and National Semiconductor, respectively, shortly afterward. . . .

Every jump in the bit-processing ability of a microprocessor requires the installation of substantially greater circuitry on a chip. All else being equal, a 4-bit microprocessor calls for only four data paths, whereas an 8-bit version needs twice as many.

Installing thirty-two data paths on an IC is obviously a vastly more complicated task. The chip above, for instance, took a squad of engineers eighteen months to design, and it is crisscrossed with some eighteen yards of microscopically thin tungsten (rather than aluminum) interconnections.

This integrated circuit was created for a new machine, the HP9000 desk-top engineering computer, and is the cornerstone of a family of ultrasophisticated chips that includes a 128K RAM, a 660K ROM, a timer, and input/output processor, and a dynamic memory controller that allows up to twenty 128K RAMs and eight 640K ROMs to be plugged into the computer. Assembled on a single circuit board, these six basic chips comprise a computer whose power exceeds that of some mainframe computers.

This IC and one by Bell Labs were the first single-chip 32-bit microprocessors. The dense grid on the right is a ROM capable of storing 9.2K words, each 38 bits long; the less dense grid on the opposite side is a register. The square grid directly beneath the register is the arithmetic and logic unit, or ALU, the device that performs the computations. The irregular circuits in the center of the chip make up the programmed logic array, or PLA, the component that decodes the instructions stored in ROM and controls the chip. The rectangular features on the chip's perimeter are test devices, epitaxial resolution patterns, and fabrication alignment marks. Actual size: 0.250 x 0.253 inches.



The Distant Future: Josephson Junctions
(IBM)

Computer scientists are obsessed with speed, their obsession motivated by the harsh economics of the computer business as much as by personal and financial ambition. Computer manufacturers are constantly striving to shave billionths of a second off the performance times of their products—long-term efforts that lead some companies to spend tens of millions of dollars. For the faster a computer, the more tasks it can execute in a given period, and the better it can earn its keep.

Of course, most computers are perfectly adequate for the vast majority of their users; it doesn't matter to most personal computer owners whether their machines need two millionths of a second to multiply two numbers or only half that. But there's a certain rarefied class of operators—NASA, the military, the National Weather Bureau—for whom no machine is ever fast enough. These are the people who buy supercomputers like the Cray-1, built by Cray Research Inc. of Minnesota, which can carry out more than a hundred million operations a second. Supercomputers are used for such highly complex chores as weather prediction and airplane air-flow analysis.

For all their phenomenal speed, supercomputers still require

hours to perform some calculations, and it may be impossible to boost their speed significantly with conventional semiconductor technology. High-speed chips generate excessive amounts of heat, particularly if they're packed closely together. Scientists at IBM have therefore been experimenting with an exotic class of ICs called Josephson junctions, which are designed to operate in tubs of liquid helium at temperatures only a few degrees above absolute zero.

As envisioned by IBM, a Josephson junction computer would consist of a central core of about fifty to a hundred chips, all packed tightly in a cube about two inches to a side and immersed in liquid helium. The entire apparatus, core and tub, would probably be about the size of a refrigerator. By cooling the circuitry to almost absolute zero (-459.7°F) and reducing the lengths of the connecting wires to a bare minimum, a Josephson junction computer might attain speeds of one billionth of a second per operation, or less, ten times faster than today's quickest computers. A full-scale Josephson junction device has yet to be made, but IBM expects to have one by the early 1990s, if not sooner. ■

In this close-up of a Josephson junction chip, the junctions themselves lie beneath the four circles in the brown regions. Ultrafast switches, they can be turned on in as little as six trillionths of a second and are made of lead or niobium—both superconductors—separated by a thin layer of insulating oxide. The narrowest lines in this photo are about 0.00001 inches wide. Actual size of the portion shown here: 0.001×0.00112 inches.

APL: A Language for Modern Times

BASIC has always been a more popular language than APL. But now that new APL implementations have become available for the PC, it's time to compare them again.

Don't let the humble acronym APL (A Programming Language) fool you. For years, APL has had a small but loyal following, a cadre of users who have often wondered why they were so few in number. But momentum in favor of APL is gathering. Four independent implementations of APL are now available for the PC; three are supplied by Waterloo (see "APL: Programming With Funny Symbols," *PC*, Volume 1 Number 11), Ideal (see "PC Blue Book," *PC*,

Volume 2 Number 5), and IBM. And with the fourth, coming at the culmination of a decade of careful development by STSC, Inc., of Rockland, Maryland, the number of users is sure to swell. STSC's fall 1983 release contains a panoply of new features designed to assist program applications development (for reviews of STSC's earlier version, see "Two Implementations of APL," *PC*, Volume 2 Number 5, and "PC Application," *PC*, Volume 1 Number 11).

Whether a language is oral or written, or solely for computer use, the classic problem for developers has been incorporating the competing features of efficiency, flexibility, power, and simplicity. For example, at one extreme of computer languages, assembly language offers high efficiency (it executes fast and has low RAM utilization) and flexibility (it is ori-

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Pictured here is the previous version of STSC's APL•PLUS/PC.

ented toward manipulation of individual bytes) at the expense of power (it needs several lines of code to complete a task) and simplicity (it is difficult to learn and implement). By comparison, BASIC sacrifices efficiency and flexibility in favor of power and simplicity.

No single language can be expected to exhibit all four characteristics to a degree that gives it unchallenged predominance, but some are impressive achievements by any measure: English, for example, with its vast vocabulary built from only 26 symbols and mathematics, with its international standardization and use in all the sciences. STSC's recently released APL*PLUS/PC adroitly combines many of the best features of these two languages while taking advantage of the technological advances that have made the personal computer commonplace. APL attains

power and simplicity by employing a large vocabulary of carefully chosen words. In contrast to Microsoft BASIC, which occu-

Whereas BASIC has about 200 different words, APL has almost 800.

pies about 55K of memory, APL requires almost 100K. Considering that today's PCs have up to 640K of usable RAM, however, the APL requirement is a worthwhile sacrifice, and with tomorrow's inexpensive multimegabyte memories, the loss of 100K will hardly be noticed. From the perspective of APL, programming in BASIC is comparable to trying to speak English with a 100 word vocabulary. Even

with this restriction, you could probably get along, but it would take a long time to make yourself understood.

Words vs. Symbols

Let's take a look at how the APL vocabulary is constructed. Taking advantage of the capability to define 256 instead of 128 keyboard characters on the PC, APL adds new symbols to the traditional ones: plus (+), minus (-), equal sign, greater-than sign, and so on. Almost all other programming languages confine themselves to the traditional typewriter characters. But why impose this constraint in the richer PC environment? For example, in BASIC

$LET A = A + 1$

means replace A with 1 plus the current value of A. Unfortunately, anyone with a

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0384

APL

high-school education knows this is a distortion of normal mathematics: A cannot equal A + 1. But once the possibility of new symbols is admitted, you can use the APL expression

$$A \leftarrow A + 1$$

for assignment of a variable and reserve the expression A = A + 1 to mean, "Is A equal to A + 1?", which in APL returns a 0 (for false).

For those who prefer words to symbols, STSC's APL comes with a built-in keyword variable. Turning on this feature replaces much of APL's special character set with common English words and allows you to enter keywords in place of symbols, as in BASIC. While this may be helpful for some users, we predict that beginners will quickly decide to switch off the keyword variable. Just as in BASIC

you would rather type the plus symbol (+) instead of writing out PLUS, so too in APL neophytes will be anxious to use the real McCoy.

BASIC	APL
10 S←0	[1] S←I←0
20 FOR I=1 TO 100	[2] I←I+1
30 INPUT X	[3] X←□
40 IF X=g GOTO 70	[4] →(X-g)/7
50 S=S+X	[5] S←S+X
60 NEXT I	[6] →2
70 PRINT S/(I-1)	[7] S←(I-1)

Figure 1: Programs in BASIC and APL for the average of a series of numbers.

Like English, APL has many more words than symbols for constructing them. Whereas BASIC has 25 special symbols, APL has 61, and whereas BASIC has about 200 different words, APL has almost 800. The same symbols

used in different combinations can have quite different meanings. For example, take addition. Both BASIC and APL give the same meaning to 2 + 3, but APL puts the plus symbol (+) to more general use. The program for the average of a series of numbers in BASIC and APL might be as shown in Figure 1.

Line [1] in APL sets both the accumulator (S) and the index (I) to 0. Line [2] increments the index by 1. In parallel with BASIC, line [3] requests input from the user and stores it in X. Line [4] branches to line [7] if X equals 0. Line [5] replaces S with S plus X. Line [6] branches backward to line [2]. Finally, if the branch condition at line [4] is satisfied, line [7] is executed, which computes and prints the average value.

Rather than using APL to mimic BASIC, let's instead take advantage of the



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APL

more sophisticated APL vocabulary. Using the full power of APL, we would write:

$$(+/\bar{X}) \div 0 \bar{X} + \square \quad \textcircled{1}$$

Breaking apart this expression and starting from the right,

 $X \leftarrow \square$

is a prompt like INPUT X, except the full series of numbers to be averaged can be entered at one time. If we enter 23 45 10 3 34 on a single line, then X will be assigned this series.

 ∂X

is the APL expression for the number of elements in X , so ρX equals 5.

 $+/\times$

is ΣX for the sum of all the numbers in X . Note here the more general use of the plus symbol (+) when used in conjunction with the solidus (/). Thus ΣX equals 115. When put together with the number of elements for X , we get

$$(+/X) \neq 0 \text{ } X$$

This expression gives us $115 \div 5$, which would be returned by APL as 23. The number of required keystrokes—68 for BASIC (don't forget the invisible carriage returns after each line) and 10 for APL—is typical of their comparative power.

APL uses symbols sparingly. What would you guess is the meaning of \times/X ? Of course it must be $23 \times 45 \times 10 \times 3 \times 34$. Here we see the APL alphabet in action. The "vowel" / is the glue that makes the "consonants" + and \times work. Indeed, all these constructions have meaning in APL: $-/X \times X = X$, $X > X$, and so forth.

Averaging is not an isolated example of APL's economy of expression, and it is typical of the difference between BASIC and APL. Try sorting. This comes up so frequently, you might think that it should have its own special symbol. APL goes one better. More fundamental than sorting is the idea of "upgrade." Take our series 23 45 10 3 34. The upgrade of this is 4 3 1

5 2. That is, the fourth number 3 is the smallest, the third number 10 is the next smallest, and so on. In APL, this upgrade is written **APL** **X**. Now suppose we combine upgrade with indexing. **X**[2 4]

As expected, STSC's APL comes with full software communications support allowing you to autodial remote computers.

returns 45 3, the second and fourth numbers in X. The sort of X from lowest to highest is $X[(APB)AX]$, which equals 3 10 23 34 45.

Now you may be getting the idea. Twenty years ago, Ken Iverson, the inventor of APL, asked what would be the most economical set of operators to add, for general purpose use, to the group found in most computer languages (+, -, =, >, ...). The answer, after many years of development, is the modern APL character set. Furthermore, he thought that if he could really have his way, the same symbols would work with single numbers, series of numbers, tables, single characters, and groups of characters. For example, it wouldn't matter if a variable contains numeric or character data; the same symbol would apply in all cases. Also, it shouldn't matter if X equals 2345 10 3 34 or 'BETS'; something like $X[\Delta X]$ should still work. And indeed it does if we preface the upgrade symbol with a collating sequence. Thus,

$XL'ABCDEFGHIJ KLMNOPQRSTUVWXYZ$
 $YZ'APLAX] \text{ returns } 'BEST' \quad (3)$
 which, we suppose, proves APL is one of
 your best bets. APL supplies the alphabet
 through a built-in system variable, $\lceil AV$.

$$x[\square_{AV} \text{ APL} \Delta x] \text{ (5)}$$

This returns the same result but uses `AV` as the collating sequence.

Carrying this one final step further, suppose X is a list of names:

STEVE
HOWARD
MARK
MARCIA

The APL expression $X[\cup \text{AV}[X];]$ returns:

HOWARD
MARCIA
MARK
STEVE

The presence of the semicolon to the right of the collating sequence tells APL you want to sort by row. Even if you have only a cursory knowledge of BASIC, you know that the BASIC program for sorting a list of names is several times longer than the APL expression.

Averages and sort are but two of numerous "idioms" in APL, which, with a little experience, an APL programmer learns to recognize at a glance. Indeed, as in English, idioms are elements of a sophisticated language. The *FinnAPL Idiom Library* (published by the Finnish APL Association, Helsinki, 1981) lists over 400 of them that have gained popularity.

As an example of the economy achieved by APL idioms, imagine writing a BASIC program to simulate shuffling a deck of cards. Imagine how many lines it would take! But if written in APL, the same task could be accomplished with merely five symbols:

52 752

This is the APL expression for sampling 52 times at random without replacement from the series 1,2,3, ..., 51, 52.

(continued)

"functions" in APL) and variables can live in directly accessible RAM at once. For example, in Figure 2, the master function MORTGAGE executes the separate

APL'S concept of an active workspace that contains many interrelated but physically and logically separate objects is extremely powerful.

functions COVER, PAGE1, PAGE2A, and PAGE2B (omitted from the listing to save space) wherever their names appear. Variables containing data are passed in the same way. This is a characteristic APL shares with Pascal and LOGO. Moreover, STSC's implementation of APL addresses all the RAM available on the PC; APL automatically keeps track of which 64K segment of memory contains each function and variable.

APL's concept of an "active workspace" that contains many interrelated but physically and logically separate objects is extremely powerful. Consider some of its uses. Code can be conveniently broken into separate segments, each of which can be separately developed and debugged. Large applications are easier to maintain because problems are easier to isolate and because new code may be added in a modular fashion. Utility programs can easily be integrated into your code without having to rewrite them each time. For example, the APL function CEN in Figure 2 centers a single line of text listed on its right within a prespecified printing width. Other examples of handy utilities include functions for displaying time and date in various formats, calculating statistics, controlling special fonts on the printer, formatting tables, printing menus, sur-

rounding text with boxes, playing prearranged musical compositions, and so forth. Indeed, it is not uncommon for an APL programmer to have many such utilities at his or her immediate disposal in internal RAM, which can be used simply by including their names in functions where they are needed.

With an APL workspace, you can create your own working vocabulary. APL can thus evolve into a highly individualized form of expression. One of the most exciting applications is to use APL to help write itself. Although the raw APL comes equipped with excellent function-editing capabilities, to which STSC has added several powerful built-in text-editing functions, you might still want to make improvements. One possibility is to have a function available that, at the press of a special function key (PF key), immediately displays the line of code containing the most recent coding error in a form suitable for immediate modification and execution. And then, after testing, you press a second PF key that picks up the corrected line and inserts it back into the function to which it belongs.

Interpreter vs. Interpretation

An additional feature of both BASIC and APL is their use of an interpreter. In an interpreter-based language, a line of code is not converted into executable machine language until that line is logically reached within a program. Moreover, after translation and execution, the translation is forgotten. Thus, if it is necessary to loop back to that line within a program or to run the same program more than once, the translation into machine language must be repeated. In contrast, a compiler first converts the entire program into machine language (object code). Only then can the program be executed. Thus, with compilation of the final program, source code lines are translated only once, and if the resulting object code is stored, it can be executed directly each time the program is run. Despite the execution time advantages of compiled programs, inter-

preted programs are invariably much faster to develop and debug. Interpreted programs, unless error-trapping routines have been invoked by the programmer, will stop execution when an error is encountered, or at any line previously designated by the user. This permits immediate test-

It is APL, not BASIC, that takes full advantage of the fact that it uses an interpreter.

ing of the values of all assigned variables, testing portions of the code within a line, changing the code, and continuing execution from that point (or some other point) of the program. Compared to compiled programs, interpreted programs also require less advance notice about data types and dimensions of arrays of data. If these considerations are properly implemented into the interpreter, many lines of "house-keeping" code necessary for compilation can simply be omitted.

But, it is APL, not BASIC, that takes full advantage of the fact that it uses an interpreter. Whereas BASIC depends on you to distinguish between numeric and character data by variable name (for example, A vs. AS), APL does not. Whereas BASIC requires that extended numeric precision be specified in advance, APL does not. APL does not share BASIC's requirement that variables containing many elements be dimensioned in advance. In fact, as you add data to an existing variable, APL dynamically adjusts the space reserved for the variable. It will even dynamically redimension a variable from a two-dimensional table to a higher-dimensional array. All you have to do is assign the multidimensional data to it. How does APL keep track of all this? In addition to storing the data, APL secretly stores with each variable its dimensions

(continued)

and type (for example, integer numeric, floating-point numeric, or character). Whenever it needs to do something with the variable, whether it is already in the active workspace or is to be loaded in from a file on disk, APL looks first at this hidden information describing the variable.

Again, by taking advantage of its interpreter, APL offers enhanced capabilities for tracing and stopping the execution of a program. Like BASIC, APL displays function line numbers as they are executed in a trace. But APL goes a step further and prints out the values of assigned variables after each line number and permits selective tracing of particular lines of a function. Like BASIC, APL has a stop feature. But unlike BASIC, the APL stop is turned on and off within the active workspace but outside the executing function by associating line numbers with a special system command. The function itself remains undisturbed. In BASIC, you are forced to add lines containing a STOP statement at strategic points in your program and then to delete these lines from the program to turn the stop off. When the interpreter uncovers an error in your program, Microsoft BASIC thinks it is sufficient to drop you off at the offending line number, whereas APL leads you by the hand by pointing to the exact location in the line where the problem was encountered. Anticipating that you may need to refer back to the error message, STSC's APL even keeps a record of it in a special built-in system variable. APL consistently implements its underlying philosophy: As much as possible, transfer the burden of programming from you to the computer.

Minutes vs. Seconds

With all of these conveniences, there must be a catch somewhere. Remember our earlier discussion of the trade-off between power and simplicity, on the one hand, and efficiency and flexibility, on the other! You may be thinking that the payment with APL is made in the form of slower program execution. BASIC, you could easily assume, must be faster than

APL. Just the reverse is true. In most applications, APL will execute more slowly than properly written assembly code. Two recent technological advances

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in computer hardware, however, have come to the aid of APL: the Intel 8087 chip for speeding arithmetic calculations and the Intel 16-bit 8088 CPU. With 32-bit CPUs waiting in the wings for many, if not most, uses of personal computers, execution speed is no longer a top-priority concern. Even so, for most applications STSC's APL will execute from about three to five times faster than interpreted Microsoft BASIC, if it is used in conjunction with a 8087 chip that fits in the beckoning, empty slot to the right of the 8088 CPU on the PC motherboard.

Even without this hardware enhancement, APL, because of certain design aspects, still executes faster than BASIC. One way to think of any high-level programming language is as a collection of machine-coded programs, one for each primitive statement or operator in the language. APL, simply because of its much larger vocabulary, provides a less roundabout route to its machine code. Whereas Microsoft BASIC will sort 5,000 integers in 2 minutes, STSC's APL will perform the same task in 3 seconds. To use our earlier example, BASIC will shuffle a deck of 52 cards in .83 seconds; APL performs the same task 3 times faster.

One at a Time vs. All at Once

APL uses yet another device to incorporate efficiency, power, and simplicity. The great saboteur of interpreter efficiency is looping. Looping forces the interpreter to repeat its decoding of the same lines perhaps thousands of times. A program that looks short on paper may be miles long to the interpreter. BASIC, like almost all other high-level languages, consistently employs loops for any iterative procedure. In the MORTGAGE program, BASIC uses loops for calculating and printing each element in the tabular output. In fact, because the output is in the form of a table, BASIC has to compound the interpretive problem by using one loop nested inside another loop. By contrast and with model efficiency, the APL program accomplishes the identical task without a single loop!

Our earlier APL example of averaging gives us a clue about how this is done. As you remember, the APL expression $+/\mathbf{X}$ returns the sum of all the numbers in \mathbf{X} . To accomplish the same task in BASIC, looping is required. APL also avoids nested loops by extending this notation to tables (and higher-dimensional arrays). For example, if \mathbf{A} and \mathbf{B} are the tables of numbers listed below,

A			B		
1	2	3	1	2	3
4	5	6	2	2	2
7	8	9	2	1	0

then in APL, $\mathbf{A+B}$ is:

$\mathbf{A + B}$		
2	4	6
6	7	8
9	9	9

APL automatically adds the corresponding elements in each table.

Remember that APL wants the same symbols to work on several different sizes

and types of data. If A is a table, what then can $+A$ be? Since we can sum A in many ways, we must develop a convention. Iverson ordained that $+A$ is a row sum and $+A$ is a column sum. Thus $+A$ is 6 15 24 and $+A$ is 12 15 18. What would you make of $+A$? Of course, it must be the sum of all the numbers in the table (a double summation), which is 45. Again, we get the same thing if we do a double sum across columns $+A$, instead of rows. APL extends this "tabular processing" to most of its operators. For example, if you look carefully at the APL function TABA in Figure 2, by the time you get to line [6], X is assigned a series of various mortgage amounts and Y is assigned a series of interest rates. Line [6] then calculates all the entries in the monthly mortgage comparison table output by the program using several APL

operators in sequence on these series. In so doing, it alone replaces the nested loop

As a calculator, APL beats any other programming language.

used in the comparable BASIC program.

The advantages of APL tabular processing are clear: faster program development, enhanced code readability, and reduced interpretive burden. In fact, APL's tabular processing, together with STSC's full screen-control features, is so powerful that the touted wonders of spreadsheet programs like *VisiCalc* and *Multiplan* look like useful, but not signif-

icant, improvements. As a test of this, we used APL to write a somewhat simplified spreadsheet program and found that in less than a week we had duplicated the most useful aspects of modern computer spreadsheets. Indeed, taking advantage of APL, our spreadsheet program has two very useful features that other commercially available programs do not have: Formulas can be defined using the more powerful APL character set, and user-developed APL functions external to the spreadsheet, but lodged in the active workspace, can be called in formulas from within the spreadsheet environment.

Calculator Unmatched

As a calculator, APL beats any other programming language. For example, a quick calculation of the present value of a

(continued)

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series of annual cash flows assigned to X , with the interest or discount rate assigned to R , is simply:

$$+ / X * (1 + R) * 1 p X$$

In APL, the asterisk (*) replaces the caret (^) symbol used in BASIC for exponentiation so that, with its expanded character set, APL can reserve a real multiplication sign (×). The handy "index generator," $1 p X$, returns a series of all the integers from 1 to the number of elements in X , and APL's series-processing capability takes care of the rest. Perhaps you want to use more advanced mathematical methods to solve simultaneous linear equations, run statistical regressions, or calculate probabilities using combinatorial mathematics? APL provides the solution with just a few key strokes to access special symbols for matrix inversion and combinations.

A good calculator should permit easy entry of data. STSC's APL comes with a

What might take many lines of code in another language will usually take only a few lines of APL.

built-in full-screen editor, which turns your display into a note pad for line-by-line character or numeric input—with numerous editing features including insertion, deletion, movement of blocks, and string search and replace.

An annoying feature of BASIC in desk calculator mode is the need to preface every line of output with the PRINT state-

ment. As you can see from all our examples, this is not necessary in APL. You just enter the problem directly and APL automatically prints the result.

Long and Thin vs. Short and Fat

Programming structure and style can be important if someone else is to read and modify your own code. We have already discussed the advantages of APL over BASIC as a result of modularity and tabular processing. APL offers yet another plus. In part because of its modularity and rich vocabulary and in part because the language encourages short, fat code over long, thin code, what might take many lines of code in another language will usually (unless it is outputting text) take only a few lines of APL. Among APL programmers it is usually considered bad form to

(continued)

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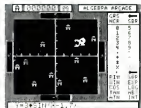
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A powerful vocabulary, an active workspace, interpreter features, and fast execution do not by themselves a computer language make. But in almost every way, you can expect the very best from STSC's APL.

What about display control? As the MORTGAGE program shows, like Microsoft BASIC, APL supports all PC screen attributes, including colors and full screen editing with windows. As an added bonus, STSC's APL supports reverse scrolling. At start up, you decide how much page memory you want. Then, you can retrieve lines long vanished from the screen as if you were pulling down a Venetian blind. Here again, APL can do everything BASIC can do, but BASIC will not do everything APL can do.

What about sound and graphics? Although APL has a built-in sound function similar to the SOUND statement in BASIC and can produce music, it lacks some of the additional features of the Microsoft BASIC PLAY statement. However, STSC's APL seems to have the edge in graphics commands because it permits a more direct approach to animation. The gap caused by IBM's current failure to provide any graphics for the monochrome display and by its somewhat limited resolution graphics for color monitors has been filled by several display adapter vendors, including Hercules, Plantronics, Orchid Technology, Tecmar, and Amdek. Unfortunately, none of these boards are compatible with Microsoft BASIC graphics statements at high resolutions. STSC's APL has the solution. Whatever board you have, you can write the same graphics programs. All you have to do is assign the name of

the board you are currently using to a special built-in variable, together with

Like Microsoft BASIC, APL supports all PC screen attributes. As an added bonus, STSC's APL supports reverse scrolling.

the desired resolution, and APL takes care of the rest.

What about report formatting and string search? Again, with the implementation of some special built-in machine-coded functions, APL beats BASIC hands down in power, simplicity, and speed.

What about filing? APL supports many special built-in functions for appending, replacing, dropping, and reading data in files, without preformatting. Not only are large data files no problem, but APL also dynamically real-locates disk file memory. Since STSC's APL for the PC is derived from APL*PLUS on its time-sharing service, the filing functions on the PC include features you would only expect to find in a time-sharing environment, such as the ability to control file access through passwords, account identification, and locks preventing the unauthorized display of sensitive code.

What about interaction with the outside world? Like BASIC, APL can read from or write to ASCII files (files that can be read from DOS). But STSC's APL has a very powerful feature absent from most high-level languages for the PC: You can execute any DOS command from within an APL user-defined function. To see what we mean, suppose between lines [2] and [3] of the function MORTGAGE in Figure 2 of the accompanying article you were to insert the following line of code:

```
ⓂCMD 'DISKCOPY A: B: '
```

After executing line [2] (which prints the cover page), control shifts to DOS, which copies the contents of disk drive A into disk drive B. In the meantime, your APL function is suspended in RAM. When the diskcopy is complete, control is handed back to APL, which then executes line [3] of the function. Although this example may not seem very interesting, see if the next doesn't intrigue you. Insert the following instruction between lines [2] and [3]:

```
ⓂCMD 'BASIC MORTGAGE'
```

Now, the equivalent BASIC program executes in the middle of your APL program, which in this case helps verify that the two programs do indeed produce the same results. This kind of APL legerdemain will save you many hours of reprogramming. Why?

If you are thinking of switching to APL, you won't need to rewrite your existing BASIC, FORTRAN, or Pascal software in APL. For that matter, whatever your favorite word processor or spreadsheet program, it can be run under the guidance of and in conjunction with

APL. You can even pass variables to and from APL and these programs, all under program control. Just use the built-in APL function `⌈CMD` with a capital C and that rhymes with P—which stands for power!

What about flexibility (ability to control individual bytes in memory)? BASIC and APL look about even as far as flexibility is concerned. Both have built-in functions for peeking and poking, interrupting BIOS, and creating and running assembly language code under program control.

What about communications support? As might be expected from a time-sharing company, STSC's APL comes with full software communications support allowing you to autodial remote computers, to shift at the press of a PF key between terminal and local modes while leaving you temporarily suspended in the mode you have left, and to upload or download data and programs. A very interesting remote host is STSC itself. STSC has purposely designed its APL PC package for compatibility with its mainframe system. If the PC is too small for your application or if you need to give other users access to your software after developing and debugging your programs on the PC, you can expect them to run with minor modification when you download them to STSC. But APL also has a smart-terminal feature accessible via a special built-in function that allows you to program automatic responses to prompts from remote hosts. It only takes a little imagination to see that, using only STSC's APL, you can turn the tables on STSC and make your IBM PC into the host!

—M.R. & S.L.

write functions longer than 25 lines. This means that most APL programs will fit nicely within the boundaries of your video monitor. In BASIC (in its version of MORTGAGE, for instance, which is 210 lines long), to see what is going on in your program you must thumb through pages of code chasing GOTO statements, and subroutines. In APL, you survey the program in one glance.

As a language for "modern times," APL should be learned with modern tools. Are you stranded in the midst of a programming error and don't know which way to turn? STSC's APL comes with a predefined PF key, which calls up specially designed screens from an STSC-supplied diskette to help you on your way. For the first time on the PC, the type of assistance provided by most good applications software has been integrated into a major programming language.

The classic APL text is *APL: An Interactive Approach*, by second edition, Leonard Gilman and Allen Rose (John Wiley, 1976), which presents an advanced treatment of APL and should be read by every serious programmer. An excellent introductory book, *APL is Easy* by Jerry Turner, was published in 1982, by STSC, Inc. Both texts are included as part of STSC's *APL PLUS/PC* package. To learn APL, first familiarize yourself with just a few special APL symbols or keywords, use APL as a desk calculator, and start writing APL functions as soon as possible. You will be able to pick up more vocabulary later on. You should find that in a matter of hours, you can quickly write short programs that would take days to learn to duplicate in BASIC.

Why Is Basic So Popular?

If APL is so good, why is BASIC so popular? Are we hiding some fatal flaw in the language?

We don't think so. Now that it's implemented on the PC, only inertia stands in its way.

But what a barrier inertia is! Have you ever wondered why typewriters and com-

puter keyboards have the keys arranged in such an odd order? In the early days of typewriters, adjacent keys typed in quick succession used to jam, so the idea was to minimize the problem by separating letters that tended to follow each other in the language. If it were not for this, just the opposite rule might have been adopted. The technological difficulty soon faded, but the arrangement of keys remained.

Seymour Papert, the principal developer of LOGO, compares the popular appeal of BASIC to the QWERTY phenomenon. In his book *Mindstorms: Children, Computers, and Powerful Ideas*, he writes that "BASIC is to computation what QWERTY is to typing. Many teachers have learned BASIC, many books have been written about it, many computers have been built in such a way that BASIC is hardwired into them. . . . Complex arguments are invented to justify features of BASIC that were originally included because the primitive technology demanded them or because alternatives were not well-enough known at the time the language was designed."

Originally APL was designed as a notation for written human communication. Only as an afterthought was it adapted to computers. BASIC, on the other hand, was invented expressly for computers with particular concern for memory size. No amount of patching can conceal this origin. This fundamentally different orientation explains much of the difference between the languages.

BASIC was invented for computers. It teaches most children and adults that computer programming is tedious and unrewarding. APL was invented as a language for thinking molded according to the workings of the human mind. Just ask anyone who uses it. They love APL! ■

Stephen D. Lewis is visiting professor of economics at Sonoma State University in Rohnert Park, California.

Mark Rubinstein has been professor of Finance at the University of California, Berkeley, since 1972.

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For the small price of this software program, you can turn your PC into one of the world's most expensive—and most powerful—desk-top calculators.

It's too bad the IBM PC doesn't come with a built-in calculator. After spending all that money, you still can't convert from radians to degrees without stopping and writing a little program to do the work. For instance

```
10 INPUT DEG
20 RAD = DEG/57.296
30 PRINT DEG; "degrees =
";RAD;" radians."
```

PC/Calculator

Micro Business Applications
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San Francisco, CA 94110
(415) 647-3381

List Price: \$35

Requires: 96K RAM, one disk drive,
DOS 1.0, 1.1, or 2.0.

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That's probably not the most complex program ever seen in these pages, but if you're in the middle of word-processing your master's dissertation and suddenly need something even that simple, it's still a royal pain in the DOS to have to make an exit, rack up BASIC, do your math, and then get back to wherever you were.

There are some things that God and Big Blue never intended the PC to be, and one of them is a desk-top calculator. It's a lot easier to keep a little Hewlett-Packard near the keyboard and turn to it in times of acute mathematical anxiety. Even if you make it a point never to trip over logs, roots, and sines, sooner or later you're going to need to do a little math, if only to figure out how much your next car loan is really going to cost you. Again, a desk-top calculator is a lot handier than the PC.

Still, after spending all that loot on a

computer, is it really necessary to go and spend more for a calculator? No, according to Micro Business Applications, which just released *PC/Calculator*. For just \$35 the *PC/Calculator* will, the company says with tongue in cheek, turn your IBM PC into one of the most expensive desk-top calculators ever invented. Let's have a look at what together the PC and *PC/Calculator* can do.

To get started with *PC/Calculator*, type CALC, which brings up a screen display like the one shown in Figure 1. The ten boxes on the left of the screen contain some of the functions found on most calculators, which, as you might suspect, are now handled by the PC's ten function keys.

The vertical column of numbers and letters represent ten memory registers (0 through 9) and a six-number stack (X, Y,

PC/CALCULATOR

and A through D). Above the function key display are four modes that may be accessed by various single-letter key-strokes. For example, typing S followed by a number from zero to nine will store the contents of the X register in the appropriate memory register. Typing an R followed by a number will push the X stack into Y and then return (RESTORE) the appropriate memory register to the X stack. And typing a C followed by S, M, or another C will clear the stacks, the memories, or everything, respectively.

The E (Enter) line is just below the stacks, followed by a line displaying the current modes of the calculator. In Figure 1 some of the memory registers are occupied, as are four of the stack positions. In addition, an error message is seen at the bottom of the screen, caused by an invalid character entry. I was lucky this time—



Figure 1: PC/Calculator's screen display in the CALC(1) mode. The bottom-line readout indicates the current status: CALC mode, DEGrees, and KEYBOARD. At the right of the screen, a paper trace of recent entries is seen.

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PC/CALCULATOR

entering the letter Q (by accident or on purpose) will exit *PC/Calculator*. So while hitting the Esc key, although the status of the various calculator modes will be saved first in a file named *CALC.SAV*, and this will be reloaded next time you start up. The contents of the registers and stacks are not saved in the file, so be careful when reaching for the numeral 1.

Writing PC/Calc Files

If you want to save the register and/or stack contents on disk when leaving the program, you must begin by typing *CALC >filename.TYP*. (The lowercase filename is, of course, whatever name you like.) Then, after you have data stored in various registers and stacks, you may write it to your disk file by pressing the P key just before using Esc (not Q!) to exit *PC/Calculator*.

It's not mentioned in the manual, but once you have set up this file, if you wish to save data without exiting, just hit the P key twice. This saves your registers and stacks immediately and lets you continue

A few minutes with
PC/Calculator is an
excellent minicourse
on calculator
fundamentals.

using *PC/Calculator*. If you clear the registers and/or stacks, you can perform another set of calculations and append the new register/stack contents to your disk file by again pressing the P key twice. It's important to clear the registers and stacks

first. Otherwise old values that have not been overwritten will once again be written to disk as part of the new data.

Although *PC/Calculator* remembers, and returns to, the modes it was in when you exited, there doesn't seem to be a way to reload the registers and stacks with the data stored in your disk file. However, as the recommended extension (.TYP) implies, you can easily view the file contents from DOS by entering *TYPE filename.TYP* and running off a hard-copy printout if you need it.

A Calculator Tutorial

It probably wasn't planned as such, but a few minutes with *PC/Calculator* is an excellent minicourse on calculator fundamentals. For example, if you make four entries in a calculator, only the last one appears on the display, and it's up to you

Let the gibberish stop here.

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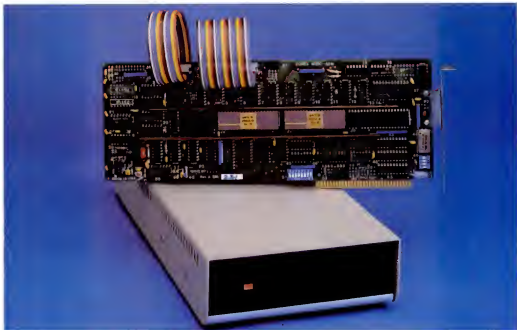


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PC/CALCULATOR

to remember the others. With *PC/Calculator* you see them all in stacks X, Y, A, and B. Now think about what happens when you hit the plus (+) key. The contents of X and Y are combined, the sum is stored in X, and A and B drop down into Y and A (that is, A into Y, B into A). Hit the plus key again and the process repeats. Once more, and the X stack contains the sum of all four entries and there's nothing left in the other stacks.

Of course, all you mathematicians out there have no trouble keeping mental track of ten storage registers and six stacks. But for the rest of us, it's great to see everything at once on the green screen.

Numeric Display Modes

For routine calculations, the decimal floating-point mode may be used, as indicated by the FLOAT legend seen at the top of Figure 1. Alternatively, a fixed-decimal (0 through 9 places) mode may be selected. It's also quite easy to toggle back and forth between binary, octal, decimal, and hexadecimal notations. As you do, the contents of all the registers and stacks are converted to the proper notation! However, accuracy is limited to the nearest decimal integer. Thus, decimal 16 and 16.5 both become hex 10.

A Floating Bug?

Every calculator and computer has its own mathematical personality, which at times produces some unexpected results. In the floating-point mode, *PC/Calculator*'s display doesn't seem to like the numeral 1 preceded by a decimal point. For example, if the values .1, .01, .001, .0001, .00001, and .000001 are entered sequentially, the six stacks will display 0.1, 0.00, 0.000, 0.0001, 0.00000, and 0.000000. Change the display mode to five fixed decimal places and the first four of these entries will show up properly. Six decimal places will correct the first five, and so on. However, even when the second, third, fifth, and sixth entries appear to be all zeroes, mathematical operations are performed with the correct values.

And if any of these decimal entries contains an additional numeral (1 through 9), a normal display is seen.

Another bug that floated by was discovered by entering the equation $1/3 * 3$ in standard Hewlett-Packard reverse-Polish notation (that is, 1, ENTER, 3, /, 3, *). This displays .0 in floating point and 1.xxx in fixed notation (xxx is as many zeroes as you've specified). As before, the mathematical accuracy of the actual calculation is not affected, so if you wind up with a big zero for an answer, you can find the real answer by coming out of floating point. Of course, this bug (and some of its close relatives) is quite popular and has been spotted in all sorts of unexpected places, including a certain personal computer that some of you may own.

The Paper Trace

Note that, as in conventional calculator operation, the X register contains the result of the most recent calculation. Thus, if you want the logarithm of 234.985, you key in 234.985, ENTER, and LOG (F8), and X will display 2.3710401404626. If you remember to fix the decimal places at three, you get 2.371, which is all you need

to match the accuracy of your original entry. But suppose you're not quite sure that you really entered 234.985 correctly. Of course, your entry no longer appears in the stack. Hitting Shift/F8 will return your entry, but now 2.371 is gone.

Wouldn't it be nice to have a "tape trace" of your entries? Nothing to it! Just toggle the Y key and the right-hand side of the screen will display your most recent entries. However, entries made before the trace was toggled on will not appear. If you'd like to have a hard-copy printout instead (or in addition), the T key will do it, but only if you loaded *PC/Calculator* by typing CALC >PRN: instead of just CALC. The screen does not indicate whether the printer is toggled on or off, so you'll have to make a trial entry if you're not sure what mode you're in. If the printer doesn't respond, clear the entry, hit the T key, and begin again.

Mouse/Calc

Toggling the M key will turn the mouse mode on and off. When it's on, the right side of the screen adds the numeric keypad display seen in Figure 2. *PC/Calculator*'s mouse cursor appears, and the entire



Figure 2: Screen display with the mouse mode turned on and the TRIG and RADIAN modes selected, as indicated by the bottom-line readout. Note the appearance of the mouse cursor at the bottom of the screen.

screen may be used with your mouse, provided it's of the type that simply becomes a supplement to the cursor movement keys. In this case, only *PC/Calculator's* cursor will be seen. If your mouse brings along an additional cursor, it probably isn't going to work. Try the cursor movement keys. If they have no effect on your beast's cursor, call the exterminator and get yourself another mouse.

Because of this, Microsoft's mouse can't be used, while the one from Mouse Systems works just fine. However, unless you're a very serious mouseketeer, you'll probably wind up using the keyboard anyway. Besides, the mouse eats up the tape-trace display, which might otherwise be seen on the right-hand side of the CRT, as described earlier.

The Function Key Modes

The function keys may be used for one of six available sets of options (CALC, CALC(2), TRIG, STAT, PROG, FIN). In the first CALC mode, the keys perform the functions seen in Figure 1. By toggling the tab key, each of the other modes can be displayed and used. For example, in CALC(2), F4 is used to sum the X stack with memory 0 and store the sum in memory 0 again. Keys 5, 7, and 9 represent cost, sell, and markup (in percent) options. If you enter any two of these, the remaining value may be calculated by pressing the shift key and the remaining function key. For example, enter your cost, press F5, enter your selling price, press F7, then press Shift/F9 and the X register will display the percentage markup. Other function keys in the CALC(2) mode perform factorials, permutations, and combinations.

The TRIG mode racks up all the regular and hyperbolic trig functions (sin, cos, sinh, etc.) as well as their inverse functions (arcsin, arccos, etc.). The often-used constants π (3.1415) and e (2.718) show up on F10. (In the CALC mode, they're both on F9, as seen in Figure 1.)

By the way, toggling Shift/Tab in any mode will alternate between degrees and

radians, as indicated by DEG or RAD in the bottom-line display.

The PROG mode allows you to perform various logical operations on binary or hex numbers (decimal numbers are con-

Who wants to tie up all that PC hardware into the world's most expensive calculator?

verted to their integer values first). This mode will be a great help in checking your binary math (11011001 AND 11 = ?). With binary numbers entered in the X and Y stacks, various function keys perform AND, OR, XOR, and 1's complement (of X only) operations. Other keys let you shift X left or right by one bit, or by Y bits.

The remaining options, STAT and FIN, are for statistics, including variance, deviation, and mean, and financial operations such as percent interest and present and future values. The manual cautions that the FIN mode is *PC/Calculator's* most complex mode; it recommends *Texts as Instruments' Executive Calculator Guidebook* for further help.

HELP Menus

There are six help menus, depending on which mode you're in. For example, with the CALC mode selected, pressing H (for Help!) brings up a display that gives expanded definitions on the function keys, a hex-to-binary conversion chart, a description of the six function key modes and a list of what the various letter key entries will do.

Obviously, *PC/Calculator's* power is considerably greater than that of a \$35 calculator. You'd have to spend quite a bit more to get one that would seriously compete with it. And, of course, even then it wouldn't have *PC/Calculator's* display capabilities.

But who wants to tie up all that PC hardware into the world's most expensive calculator? Wouldn't it be better to spend whatever you have to spend to buy a free-standing calculator that will do whatever you need to do? If you need to do some calculating while computing (and who doesn't?), you'll no doubt want independent access to both your calculator and your computer. This suggests having them as separate components.

On the other hand, if it's mostly an either/or situation, for 35 bucks you can't go wrong with *PC/Calculator*. Come to think of it, for 35 bucks you can't go wrong—period.

Still, it may be possible to have the best of both worlds. Remember North American Business Systems' *Memory/Shift*? It didn't exactly open to ecstatic reviews here a few months ago (see "Memory/Shift: Nine Heads Are Not Necessarily Better Than One," *PC*, Volume 2 Number 4). Contributing Editor Stephen Manes found that more often than not, his memory-shifted programs regularly crash landed, while his PC took off for outer space and couldn't be brought down without pulling the plug.

Memory/Shift's behavior seems to be—to put it mildly—program dependent. It can work like a champ with *WordStar* in one partition and something else in another—depending on what that something else is. However, for the working word processor (the person, that is, not the software), *Memory/Shift* can be a god-send. Just load *PC/Calculator* and (in my case) *WordStar* and you've got your calculator and your word processor in one package. Or, load BASIC instead and presto: a calculator and a computer. At 3 a.m. it sure beats trying to mentally calculate what the hell &HFE means in decimal. At any hour, that's something even my H-P 41CV doesn't know.

Of course, by adding *Memory/Shift*, you jack up the cost of what is already the world's most expensive calculator by another \$95, but, to this reviewer at least, it's still a bargain. ■

A Computer for Chartridge

Members of Chartridge, an association of homeowners in Maryland, use the PC for tasks ranging from budgeting and collecting property assessments to policing the swimming pool.

Chartridge, an association of homeowners in Anne Arundel county, Maryland, is using the PC and compatibles to govern its affairs of estate. The estate consists largely of common grounds and a community swimming pool and is supported by a budget raised almost exclusively through yearly assessments. The PC provides spread-sheet and database capabilities to streamline the association's activities, which include budgeting and allocating the use of the swimming pool. The association's plan to computerize is now just unfolding. When implementation is complete, the residents of Chartridge believe that the good life will be even better.

The idea of using a microcomputer to

do a portion of the association's work was first introduced by the board of directors in the fall of last year. The response of the general membership was overwhelmingly positive. Members were ready to commit themselves to the purchase of a computer system, which would cost thousands of dollars. A minority opposed the idea altogether, not only on the grounds of cost but also because of privacy. They feared computerized financial records—especially those relating to the financial standing of individual association members—could easily be abused. Between these two extremes of headlong endorsement and wary opposition, the board charted a moderate course of phased implementation.

The first and current phase, the use of

private hardware and software by volunteers doing the association's work, has occurred naturally over a period of several months. The treasurer had access to the portable Chameleon and a Columbia and was interested in using them to do the association's general ledger accounting.

These activities have their origins in the covenants that bind Chartridge together as a legal entity. The covenants grant membership to each homeowner in the community association and place certain restrictions on the use of the property and changes to the home. The association has the responsibility to enforce the covenants and to maintain common property, especially the swimming pool. It also has the power to assess each of its members a fee

CHARTRIDGE

to maintain the common ground and make capital improvements. The association is administered by an elected board of directors, who are aided in their conduct of day-to-day business by several volunteer committees.

To the extent that Chartridge is like a small town it can use a computer in the same ways that local governments do. Towns and counties need to maintain lists of residents and property owners, keep track of who has paid taxes, and who is eligible to vote. The computer can be used for bookkeeping and to generate reports for elected officials and the public. Chartridge has similar database and bookkeeping needs. The group could also use the computer to prepare mailings, notify members of association meetings, and help prepare the community newsletter.

On the other hand, some of the prob-

lems Chartridge faces are different from those faced by incorporated towns. Although the association is a legal entity and its decisions are binding for all property owners, its only recourse against violators

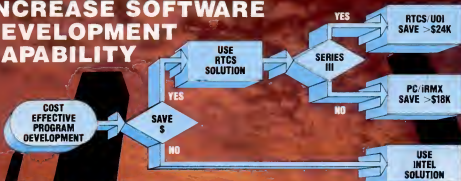
The pool committee has a PC-generated list of residents showing who has paid his assessment.

is through public pressure and, ultimately, court action. There is no Chartridge police force to prevent residents from conducting businesses in their homes or otherwise

violating the covenants, and no tax collector is empowered to force the sale of homes whose owners refuse to pay their assessments.

Although PC doesn't stand for Police Computer, it can do an effective job of policing the payment of assessments by using spreadsheet and database programs. By helping to maintain an up-to-date, accurate list of residents who have not paid, the PC facilitates enforcement of the collection process. Residents must pay their assessments if they want to vote at community meetings, hold office in the association, or use the community common areas. Of the several available sanctions, only limiting access to the swimming pool is an effective lever for collection. The other lever the association can use is a lien on the delinquent member's property. Both measures require careful

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planning, a process that has been enhanced by the PC.

Limiting access to the swimming pool helps speed collection in the short term. The pool committee has a PC-generated list of residents showing who has paid his assessment and who is delinquent. Because the PC makes it easy for our treasurer to provide the pool committee with exact information on the amount owed and the dates on which notices were mailed, the committee becomes an effective collection agency.

Don't Lien on Me

Over the long term there are always some residents who don't care to vote at meetings or use the pool. The only way to collect from them is to file a condominium lien on their property. Thanks to our covenants, the liens are enforceable, and we

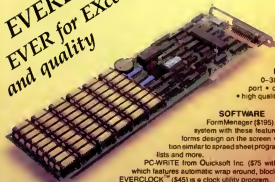
have been successful in collecting back assessments, interest, and reasonable attorney's fees. Liens can be collected only when the property is sold, and filing a lien is a drastic step, with up front filing costs that the association must pay. For these reasons we try to give residents an opportunity to pay voluntarily. We must be careful, however, not to let a home be sold with outstanding assessments and no lien. There is little hope we could collect on those accounts. The PC helps here by generating a list of outstanding assessments for comparison with a list of homes for sale obtained from a local real estate broker. The aggressive enforcement of this option not only ensures that we lose fewer dollars but has also caused local title companies to routinely inquire about the status of assessments on homes in Chartridge when they go to settlement. Because the

data are on the PC, we can answer these inquiries promptly.

When liens are attached to a property, it means that the association, among other things, must make up the budget shortfall caused by the uncollected assessment. Consequently, the budget must contain an appropriately sized reserve based on past experience and the treasurer's best estimate of future contingencies. With the PC, the group expects, in future budgets, to predict much more accurately the portion of the current unpaid balance that can be collected and when. By entering this data in a simple spreadsheet model, the group can decide what it needs for an adequate operating income and a reasonable contingency with a minimum assessment. Residents can only be happy about a plan to take a smaller bite out of their incomes.

(continued)

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CHARTRIDGE

In spite of its obvious value and many areas of application, the PC is not yet a permanent part of Chartridge. The machines and software are privately owned, and computer-literate volunteers—never numerous to begin with—could leave the association and move to other communities. Moreover, lists of property owners can be maintained without the help of a computer, and mailing labels can be produced by photocopying. Even the fairly time-consuming task of updating the rosters of residents' swimming pool and association voting rights can be handled manually as assessments are paid.

Later Stages

But because the PC standard is spreading so dramatically, the prospect of permanence is also growing. A more permanent status for the computerization of Chartridge is a matter for consideration in the later stages of Chartridge's implementation plan. So is the integration of the software that would make the use of the PC dramatically more attractive than manual operations. Given the power of the IBM PC, it becomes possible to automate all the association's computerized functions through a single facility, just as local governments do using minicomputers. The group plans to achieve integration in two additional stages.

The first stage involves separate financial and database operations. Residents use their own computers for community work. In the second stage, the community association will purchase a software package that provides all these functions. Updating our accounts receivable and voter eligibility files will become a single operation. The association will still be using borrowed computers, however. Before the community will consider buying its own PC, it believes it must reach stage three. This will utilize all the potential of the PC to make the software self-explanatory. At this point, community officers will be able to use the computer without needing to rely on trained users.

The software for stage one is a spread-

sheet for the financial data (*PerfectCalc*) and a simple BASIC program for the database. The records kept consist of a general ledger and a mailing list. The spreadsheet program automatically totals the ledger entries in about a dozen accounts and creates a report comparing actual to budgeted expenditures. The mailing list has been augmented with information on assessment payments and provides our primary tool for controlling accounts receivable. We didn't put any analytical effort into choosing these programs but used them because they were already available for computers in our community. The programs' features were less important than the lessons we could learn from using the computer.

Stage one taught us that "fill in the blanks" software is not sufficiently easy

Stage one taught us that "fill in the blanks" software is not sufficiently easy.

for the uninitiated user. It is rarely clear which blanks must be filled in, and only our treasurer understands the process sufficiently to determine whether the results are reasonable.

Another lesson the association has learned is that relying on borrowed computer time is also unacceptable. People move, and unfortunately, their level of interest in community affairs often wanes after a year or two. When the community commits itself to automating its accounting and records, it cannot afford to lose its computer. This is where IBM has made a significant difference. Thanks to the standardization occurring around the PC, users now have access to a large number of functionally similar computers (two IBM PCs, two Columbias, and a Chameleon). The community can buy its own software and supplies and can create a group of program and data disks that can

be run on any of several machines.

There is substantial community support for such a move, even among residents who might normally oppose a purchase of only several hundred dollars. As a result, we are approaching stage two by examining several integrated packages with the hope that spreadsheet type entries will be sufficient to update not only our financial reports, but also our mailing list and its records of delinquent assessments and architectural data. It appears that most of the commercially available programs will achieve the level of integration necessary to make the IBM PC worthwhile, but the problem of operator training remains. Only someone who works with the package regularly will know how to use it. For this reason Chartridge will continue to need resident owners.

The ideal software would obviate this need. It would maintain records of about 500 financial transactions each year. In addition, it would hold a permanent database with entries for each of 350 homes. Each data record would occupy 256 bytes on the disk. People with no prior computer experience who only deal with this program about once a month must be able to make the entries and will thus require self-explanatory menus, on-line help files, and foolproof error recovery.

Such software is certainly possible to obtain. Programs could be written in BASIC and compiled if necessary to achieve reasonable speed. They could also be created as an application using a package such as *dBASE II*. Because the data formats and on-line help the group would like to use must be very specific, it is unlikely that existing software would meet these needs. The group is also skeptical about the long-term reliability of programs it writes. This dilemma cannot be resolved easily, nor should it be. The application of personal computers to community-type business is not yet mature. Chartridge recognizes the potential presented by the IBM PC, but the town intends to move slowly and wait for software development to catch up to its needs. ■

New Wave Data Management

Nutshell, DataPath, and Power-base are database management packages without an embedded programming language. These three new products may challenge dBASE II's market position.

Two waves of change are about to occur in the management of data on small computers. To fully comprehend where we are going, it's important to understand where we came from and where we are. The status quo and the future are both defined by *dBASE II*, the undisputed king of the data management hill and the best-selling package for the PC today.

What Wayne Ratliff and Ashton-Tate did when they created *dBASE II* was to put most of the relational database management model on small, 8-bit computers. This approach is so successful because it addresses the programmer, as opposed to

the user, and thus is suitable for the rapid construction of very powerful application systems for the user population. Though *dBASE II* is complicated, programming in its built-in language is simple enough for the more sophisticated user.

Two years ago, I would have said systems like *dBASE II* represent the future of data management on small computers. Apparently I wasn't alone in my assessment, because today there are more than 25 products in this category, almost all of which try to prove their worth by comparing themselves favorably to *dBASE II*. Although there are many differences among these programs, after the sheen of the slick presentations has been peeled away, it is often difficult to tell one from another.

Almost all these *dBASE*-like products share one *dBASE II* trait: They have their own programming languages. One product, *Revelation*, by Cosmos, uses a conventional programming language (BASIC) and has the data-handling facilities built in. The other database systems vary in complexity from simple to obscure. Each has a different syntax for its language and a unique environment that must be managed with the facilities of the particular product. Even something as simple as an IF-THEN-ELSE statement is not transferable from one program to another.

The proliferation of languages raises

one of my pet peeves: I dislike having to develop an applications program to solve relatively simple data management problems. Most of my data management problems are straightforward, and even those that are complicated enough to exclude the more simplistic products are still solvable by programs in the *dBASE II* genre. I'm resisting the urge to program.

Let me take a moment to explain how strong this aversion is, even though I am a programmer by training and experience. For the past year, I have been working on *PC Tech Journal*. The managing editor, Marjory Spraycar, and I have placed in operation a number of administrative and control systems that could be improved by computerization. If the computer were to keep our records and produce our reports, our busy work would diminish greatly, and the production process would become more efficient and less prone to error. Despite the obvious benefit to be gained, I have not begun the work yet, simply because I do not wish to engage in an application development project. In short, I do not want to program.

The pressure increased when *PC Tech* went monthly: Our workload increased, and the number of details that we have to track tripled or perhaps quadrupled. Now we have to juggle work on several issues at a time, which complicates the matter even further. We've just got to get the computer

DataPath

Satellite Software International
288 W. Center St.
Orem, UT 84057
(801) 224-8554

List Price: \$595

Requires: 64K RAM.

CIRCLE 733 ON READER SERVICE CARD

Power-base

GMS Systems, Inc.
12 W. 37th St.
New York, NY 10018
(212) 947-3590

List Price: \$395

Requires: 256K RAM, two disk drives.

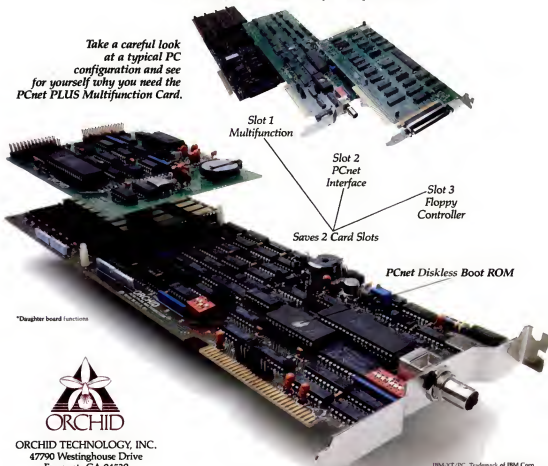
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DATA MANAGEMENT

working for us. The note of desperation in my voice is real, but so is the chance that I might be saved by the first wave of change in database software.

Just in the nick of time, new products have emerged that promise to exempt me from the obligation to program, at least in the conventional sense. The products share one common trait: They *do not* have an embedded programming language. They operate completely interactively, are mostly menu-driven, and they have enough power to solve most, if not all, of the conventional kind of data management applications. I'd like to tell you about three of these products, each of which has its own character.

Nutshell

The first product, originally named *FlexiFile* but now called *Nutshell*, was written by Nashoba Systems of Lincoln, Massachusetts, and will be marketed by Leading Edge Products. (For information contact Leading Edge at 225 Turnpike St., Canton, MA 02021; telephone (617) 828-8150.) As the simplest of the three products, it is actually somewhat out of place in comparison to the other two, but it has some powerful features that are present in no other product that I know of. The program might be awkwardly classified with *PFS:File* and *Fast Facts* as a "notebook system."

Nutshell handles text data like a virtuoso. Maximum field lengths are quite long. A record can be a "page" of data consisting of up to 65,000 lines of 240 characters each, although in actual use, records will most likely fit on one display screen. A field can occupy more than one row and thus can be defined on the screen as a rectangle of arbitrary size. As data are added or edited, the field is reformatted to fit the rectangle. The rectangle can also be changed in shape or size, and the data will reformat accordingly.

What makes the product stand out is that each word in every field is automatically indexed. The system thus performs free text retrieval, which simply means

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DATA MANAGEMENT

that the user can specify retrieval of records by supplying words or prefixes of words. If you have a file of used cars, for instance, the words *big*, *blue*, and *GM* might be used to find cars in your inventory to fill a particular customer's order.

An additional feature that sets the Leading Edge product apart from other notebook systems is that multiple views (screen formats) can be described for each data set. Other notebook systems couple the screen format so tightly with a file that only one view is possible. Any of the multiple views can also be used as a report format.

Leading Edge plans to eventually integrate *Nushell* with its word processor for the PC.

Power-base

GMS Systems in New York City bills its product *Power-base* as a combination of the relational and hierarchical data models. A number of features give this product its power.

The most important feature is the hierarchical structure of the data and GMS's access method called "*datazoom*." It is possible to "zoom" from one screen to another, a feature that is most often used to focus on increasingly greater levels of detail. For example, consider a customer statement that shows all recent invoices and the payment status of each. By placing the cursor on a particular invoice amount, the user can zoom to the actual invoice to examine the order in detail. From the invoice, the user can zoom to a particular item's listing in the catalog to examine its full description or perhaps to the inventory to check its current stock level. The user can "unzoom" step by step, return directly to the highest level, or abort and switch to an entirely different file.

Power-base can also display information taken from other files or calculated from other files. Like Leading Edge's *Nushell*, it also permits multiple views of the data to be defined. The combination of features allows you to develop many complicated applications.

DataPath

DataPath is a new data manager from Satellite Software International, makers of *WordPerfect*. It is distinguished by the way it interacts with the user and by its data model. It is a networked system, which is the most difficult of all data systems to implement.

DataPath includes many of the attributes of the other database products mentioned here. However, three features distinguish this product: its windowing capability, its network model, and its speed of operation.

DataPath windows, called panels, allow multiple views of the same or different data to be seen at the same time. Panels may be stacked on the screen and moved or eliminated as desired, much like sheets of paper on a desk. Moving from panel to panel is facilitated by the network model, which allows arbitrary linking of one panel to another. Because of this flexibility, complex relationships between data elements can be defined. The speed of operation allows quite rapid movement between panels—a tedious, time-consuming task in many data managers.

According to its manufacturer, *DataPath* can be used to develop applications of considerable complexity. As a demonstration, SSI is implementing its own legal time and billing system, *SSI*Legal*, in *DataPath*. This new product was previously written with conventional programming techniques.

These three products have much to recommend them. They are all easy to learn and use and do not have a programming language. They all perform well, and each seems to have a certain scientific consensus behind it, rather than one person's view of how data should be managed. *Nushell*, *DataPath*, and *Power-base* are part of the new wave of data management.

And what is the second wave bringing changes to data management on small computers? The answer is simple: these same products in a local network environment. ■

Driving the New Diggermobile

Digger is a challenging and fun new spinoff from the arcade game Dig-Dug. It may face stiff competition from several real arcade games that Atari has just released for the PC.

I can dig it. So can you. *Digger* is another capable, entertaining transplant from the world of the shopping mall arcade to the small screen of your IBM PC. It's the second of such successful clones from Windmill Software reviewed here. (The first was *Slyx*, which was reviewed in *PC*, Volume 2 Number 7.)

Digger is a nugget from the same lode that produced *Dig-Dug*, a favorite in the arcades a year or so ago. Your assignment, should you choose to accept it, is to "collect precious gold and emeralds buried deep in subterranean levels of an old abandoned mine. With your motorized Diggermobile, you tunnel out new shafts (see Figure 1), scoop up emeralds, and race ahead while dodging falling bags of gold and avoiding wide-eyed Nobbins hot on your trail." Great literature, it ain't; good fun it is.

Let me translate this "story line" into game play: You are the controller of a little

Digger

Windmill Software, Inc.
2209 Leominster Dr.
Burlington, Ontario, Canada L7P 3W8
(416) 336-3353

List Price: \$39.95 (U.S. dollars)

Requires: 64K RAM, color/graphics adapter. Game adapter and joystick are optional.

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motorized digging machine inside the mostly unexplored interior of a gold mine (probably the only gold mine where the wealth comes prepackaged in burlap bags, but never mind the small details). Using a joystick or the arrow keys on the cursor pad, you direct the movement of your digger in search of goodies: bags of gold or several dozen emeralds sprinkled around this unusual geologic formation. You collect the emeralds by maneuvering your

digging machine's hungry maw through the bedrock; you tote up your golden winnings by carving out passages beneath the bags and letting them fall to the mine floor below—they split open, and you may gather up the nuggets.

Plenty to Dig

Now, if your only job were to glom onto precious stones and nuggets, then you might say there wasn't that much to

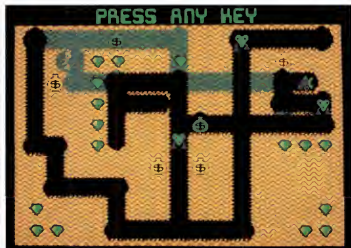


Figure 1: In *Digger*, you control a "motorized" Diggermobile to collect "precious gold and emeralds buried deep in subterranean levels of an old abandoned mine."

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PC ARCADE

dig in *Digger*, but no! For some reason the mine shaft is infested with—don't ask me what they are—Hobbins and Nobbins (see Figure 2). The Nobbins enter the mine shaft at the top right corner of the screen and scurry through the passages you've opened. The Hobbins appear a bit later and are capable of digging their own channels of hot pursuit. Both will eat you up (you have three lives), but as you might have guessed, you have ways to kill these creatures: You can shoot fireballs at them if they are in the same shaft as you are, or you can time your actions so that one of the falling bags of gold collides with a climbing Hobbins or Nobbin.

Once all of the creatures have entered the shaft, a cluster of cherries (don't ask me to explain these, either) appears in the upper right-hand corner of the screen. If you can climb up there to grab hold of the cherries without losing your life, you can turn the tables on the Nobbins and Hobbins—shades of *PacMan*. The pursued becomes the pursuer, at least for as long as it takes your PC to play one chorus of the *William Tell Overture*.

The animation of the principal players

is cute, and the graphics are well done. The sound effects are quite good (including a nice tottering noise when one of the

If you can grab hold of the cherries without losing your life, you can turn the tables on the Nobbins and Hobbins—shades of *PacMan*.

bags of gold is about to plunge), and somehow the garish Spaghetti Western musical score in the background seems to fit. Nonetheless, the game's sound on/off toggle is something to be thankful for. The program design is appropriately bullet-proof. I was unable to crash it during my testing. On an RGB color screen, the various mines are presented against an attractive and unusual herringbone pattern, a nice break from the black or IBM blue of most games. On a monochrome screen



Figure 2: Your *Digger*mobile is chased by hungry wide-eyed Hobbins and Nobbins who want to turn you into a quick lunch.

PC ARCADE

attached to the color graphics adapter, the game elements—in different shades of green—were sufficiently distinct, although a monochrome version would have been a plus.

The game is playable with a joystick or from the keyboard—in fact, I found I could rack up higher scores using the cursor pad. The keys, alas, are not redefinable by the user: The up, down, left, and right arrows are assigned for movement and the F1 function key for discharging fireballs. It's a workable set of keys, but my touch-typing-trained fingers like to use the space bar for downward movement. The game maintains a table of high scores, with room for the initials of the players. Two players can alternate turns, using the same joystick or trading places at the keyboard. There is also a pause-and-resume control. The game is copy-protected.

Like all successful arcade games, *Digger* is progressive: it is reasonably easy to learn the early moves and break into the

It is reasonably easy to learn the early moves and break into the upper screens, at which point the play becomes more challenging.

upper screens, at which point the play becomes more challenging.

Like Windmill's other offering, *Digger*

is a winner.

On PC's scale from one to six, *Digger* scores:

FUN:	4.5
CHALLENGE:	4
GRAPHICS/SOUND:	5
TOTAL:	13.5

Digger is based on a proven arcade hit, and until just recently this type of spinoff (or ripoff, depending upon your point of view and whether you personally own the copyrights to a design) has had the market to itself. There have been dozens of versions of *PacMan* and *Qix* and *Space Invaders*, but the real thing has remained accessible only with the aid of a roll of quarters.

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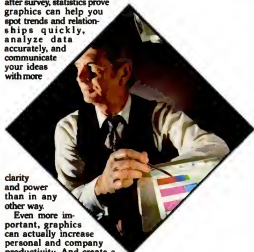
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184-19

PC ARCADE

arcade hits didn't want to jeopardize their take from the machines. There were also strings of legal agreements—often stretching all the way to Japan—that held the rights to the games hostage. And finally, until the advent of the IBM PC and other 16-bit computers, and until the market for games was established, it was very

Atari has released PC disk versions of many real arcade hits, including Dig-Dug, PacMan, Defender, Donkey Kong, and Centipede.

difficult to translate the complexities and speed of true arcade favorites to micro-computers.

Digging Up Dig-Dug

Digger, of course, is loosely based on the arcade game *Dig-Dug*, a challenge in which you are called upon to direct a little creature of the same name. He burrows his way through the earth in search of vegetables and fruits, but finds himself pursued by Pooka the robot, Fygar the dragon, and other denizens of the deep. There are falling rocks, hidden treasures, and a special *Dig-Dug* song that accompanies his every move.

Well, if that sounds more exciting than the clone reviewed here, or if you've run out of quarters and just happen to have an IBM PC at home, you can relax, for Atari has now released a set of PC disk versions of many of the real arcade hits, including *Dig-Dug*, *PacMan*, *Defender*, *StarGate*, *Donkey Kong*, *Robotron 2084*, and *Centipede*. We'll review some of them in upcoming issues of PC, so keep those joystick fingers limber.

Don't Be a Computer Wimp

Learning to use a computer ought to be no more intimidating than learning to drive a car. Here's some Driver's Ed to get you started on the road to computer competence.

Not surprisingly, at 8 years of age, the microcomputer industry still exhibits the bumptiousness of a youngster, but few newcomers to the field realize that this youth can present obstacles to their personal attempts to reach computer nirvana. Exasperation is the common denominator of first-time computer buyers, and with good reason. For all the highly touted logic of the microcomputer, the 8-year-old side of its personality often seems to hold the upper hand.

In fact, common sense and maturity are anything but familiar sights to the addled strangers entering the strange land of microcomputers. Products that ought or claim to be compatible aren't; instruction manuals plumb the depths of incomprehensibility, manufacturers expect the buyers of a program to exterminate their bugs for themselves, salespeople go ahead and answer questions they don't really know the answers to, and small problems lead to ever bigger ones.

Computer Wimp: 166 Things I Wish I Had Known Before I Bought My First Computer!

John Bear, Ph.D.

(Ten Speed Press, Berkeley, CA, 1983)

286 pages; hardcover, \$14.95; paperback, \$9.95

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Have patience; the industry is still a child. These problems will work themselves out over time. In 10 years, buying a computer will have all the mystery and excitement of picking out a sewing machine, and we'll look back nostalgically on this pioneer era of micro madness.

Until then, we have three trusty guides to help us through by pointing out where the dangers lie. These include Peter McWilliams' book-that-spawned-an-industry, *The Personal Computer Book* (Ballantine, \$9.95) and Michael Crichton's *Electronic Life* (Knopf, \$13.95). And now John Bear joins the list with *Computer Wimp*, a book with the sensibi-

ity and charm to belie its inauspicious title.

Oh, there have always been computer books that promised to hold your hand during the bumpy spots, point out landmarks, warn you to keep your hand on your wallet in shady situations, and remind you to get your shots before heading off to the mysterious land of the microcomputer. Despite their claims of companionability, most of these books were not too helpful.

McWilliams Was First

But when *The Personal Computer Book* appeared, for the first time people told their friends, "I wish I'd had this book before I bought my computer."

Clear, confident explanations and a beguiling directness characterize McWilliams' writing. He assures you that he'd never steer you in the wrong direction. You like him right away because he's fresh and frank. He earns your trust and, lest anyone rely too heavily on his advice, he warns, "Please do not consider me an expert. Think of me as, say, a friend of a friend and hold my recommendations in that light." He advises, "Don't let me, or anyone, select a computer for you." At a time when there simply weren't enough experienced hands to go around, McWilliams' book was a knowledgeable, helpful, trusty, chatty stand-in—the next best thing



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BOOK REVIEW

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Crichton Was Next

Michael Crichton, the doctor/director/novelist, also easily wins a reader's trust. He sets out to change apprehension about microcomputers into eagerness. (For a complete review of *Electronic Life*, see "Living And Communicating With Computers," *PC*, Volume 3 Number 1.) His twin goals of telling readers, "Here's what computers can do for you" and "Here are the simple facts," characterize the brief essays—which were expanded from notes he worked up for friends—that make up his book. With consummate casualness, Crichton dispenses advice and practical observations on technology, techniques, specifications, problems, disasters, and terminology. He eases the novice's frazzled nerves and instills confidence: Mastering these concepts is within our capacities. Take his discussion of computer jargon as an example: Crichton points out that a stereo system has a vocabulary that is every bit as confusing as computer terminology—words such as *tuner*, *amplifier*, *Dolby*, *watts*, and *fast forward*. It's just that the specialized terms relating to your stereo system have been demystified by 30 years of assimilation. (However anyone who still finds stereos too complicated to use might want to think twice about owning a computer.)

And Now There's Bear

In *Computer Wimp: 166 Things I Wish I Had Known Before I Bought My First Computer!*, John Bear steers a middle course: He is as thoughtful and wide-ranging as Crichton (but not so button-down and terse), as practical-minded as McWilliams (but not so funky and machine-specific). In the margins of his straightforward and congenial text Bear has placed short, quoted observations on computers and society ("If it works it's out of date," Stafford Beer), 19th-century illustrations that have been ironically updated to include computers, and 166 special remarks distilled from the text and his 10 years of

experience working with small computers.

Naturally, Bear covers the essential territory for any book purporting to advise the first-time computer buyer. He passes the first critical test of an introductory computer book by stressing four fundamentals newcomers to computers should commit to memory. They bear repeating here.

- Pick your software first, and then the hardware that will run it.
- Never be the first kid on your block to buy anything new. Allow time for egregious bugs to be corrected and for the price to sink.
- Buy the same machine and software your friends have. The hours saved in education and trouble-shooting and the advantage of having an emergency backup make an enormous difference.
- Despite the redundancy and inconvenience, when installing a computer, keep your old, manual system running for 3 more months before junking it.

Stories illustrating the necessity of following this last dictum are invariably poignant, expensive, or both. Bear's own case cost him \$28,000: "I desperately wish someone had not only told me this when I got my first computer, but beat me over the head with it, watched me closely to see that I heeded it, and put itching powder in my socks every day that I didn't."

You have to go through a lot of seemingly wasted effort to follow that particular piece of advice, Bear admits, but it's the only insurance against the following sequence of events: computer arrives; old system abandoned too soon; computer fails; big problems arrive.

The Old and the New

Familiar material is handled expeditiously by Bear, but he also includes fresh information and infrequently noted considerations.

His 18-page section on computer stores, sales help, and the reliability of sales brochures, for example, contains more than a justifiable skepticism. He

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BOOK REVIEW

actually tested retailers by calling 50 computer stores across the country in an informal survey. He asked them two questions and indicated to them that his interest might lead to a purchase. One question was simple, involving the compatibility of an Apple II+ and a Qume Sprint 5 printer. The other question sounded simple but was actually somewhat complicated. He asked whether it would be possible to transfer information between an Apple II and an IBM PC via telephone lines.

The results were dismal. Only one "expert" out of all 50 stores could answer both queries correctly. (The correct answers are "yes" and "some methods may work, and one company makes a product that claims it can do this," respectively.) Number 38 of Bear's 166 aphorisms was inspired by his survey. It reads, "Get a second or third opinion on all important computer questions, no matter how confident the first person sounds."

Among Bear's other pragmatic observations, he notes that many difficulties are caused by simply moving a computer about. Other writers counsel you to be careful. Bear goes ahead and calls computers fragile and succeeds in getting you to believe him. He admonishes, in the epitome of understatement, "Never buy anything you can't lift" (number 102 on his list). That's exactly the kind of knowledge you want to pay for, rather than acquire first-hand. And it's the kind of knowledge that *Computer Wimp* provides.

A Few Quibbles

I have a few quibbles with the book: I believe error-checking transmissions should take care of Bear's reservations about using modems and he incorrectly attributes an anecdote about Gauss to Fermi. But the book's thoroughness on such subjects as shopping for software and how to make corporations respond to you leads me to dismiss my personal objections as inconsequential. Rule 38 (about getting a second opinion) can be invoked in other matters. What's really important is how

BOOK REVIEW

civilized computer buying is becoming, thanks to new Baedekers such as *Computer Wimp*.

Excerpt: If you are all through with school, and unlikely to take up brain surgery or differential calculus as a hobby in your later years, learning to use a computer is probably going to be the most complex and difficult mental activity you will experience between now and the end of your life.

There is nothing wrong with this—indeed, for some people, the intellectual challenge is more stimulating and satisfying than the end result. But for people who have grown accustomed to plugging in a refrigerator and immediately filling it with food; or buying a new car and spending at best a quarter hour with the owner's manual to learn how to work the radio, air conditioning, and six-way power seat, there is a rude awakening in the realization that it will be many hours, probably days, perhaps weeks or months, before one can drive the computer slowly around the block.

Excerpt: I was talking to the manager of a computer store when his assistant came over and interrupted us:

"You're wanted on the phone," she said to the manager.

"Who is it?"

"I'm afraid it's another riffim."

The manager grimaced and reached for the telephone, whereupon, with exaggerated politeness, he proceeded to "talk a customer down" from some horrendous problem he or she was suffering.


Of course I had to ask. The manager blushed quite profusely, and informed me that "riffim" was just a little joke of theirs.

Not quite so.

Diligent research has yielded the information that computer store personnel regularly refer to certain customers as "riffims" (or, more accurately, "ryfms"). RYFM stands for Read Your F— Manual. And, so, of course, a riffim is some-

one who calls up or comes in to buttonhole a store employee when the answer to his or her question is clearly stated in the instruction manual. ■

Luther Sperberg, a New York editor and writer, was educated in Texas, Mississippi, and Germany. His computer experience dates back to 1966.




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


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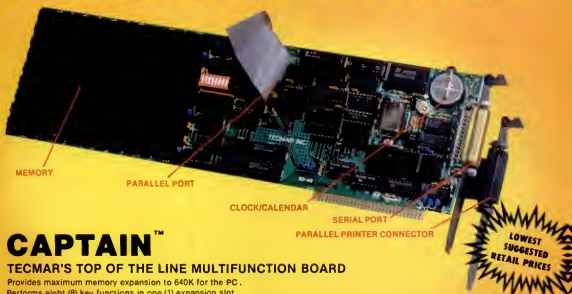
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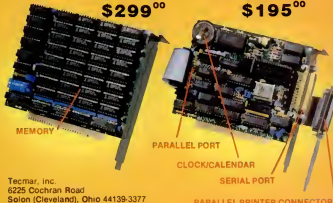
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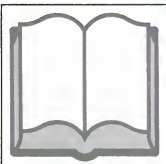
Writers with word processors are now telecommunicating with typesetters, but there are still a significant number of obstacles to overcome before the process is letter-perfect.

Word processing programs are rapidly becoming indispensable tools of the writer's trade. The writer, armed with a PC and *WordStar*, can now send copy directly to the publisher without ever lifting a pencil or leaving his home. Perfect, right? Well, not quite. In order to make the operation more efficient, the word processed copy must be coded so the typesetting machine can properly format it.

Fortunately, such a system is no longer just a pipe dream. Computer-typesetter telecommunications packages are available from many major typesetting manufacturers. Although a perfect interface between these two alien forms has yet to be devised, a telecommunication system that enhances your typesetting operation—whether you are a large book-publisher or a company newsletter—can certainly be worked out. The publisher should be warned, however, that you can't turn word-processed prose into typeset copy at the push of a button—at least not yet.

Developing an Interface

On a word processor, which mimics a typewriter, a space is a space, whether occupied by a capital *W*, or a lowercase *i*, or by nothing at all. On a typesetter, the term *space* means nothing without a prefix. It can be an em space, en space, thin space, word space, or letter space, so



instructing an operator to "indent paragraphs five spaces" is meaningless.

A typist with a 5-inch line knows that it will hold either 50 characters (pica type/10 pitch) or 60 (elite type/12 pitch). The typesetting operator, similarly, can determine the number of characters per line by knowing the type style and size. However, what the typist has determined as the correct number of characters per line and what the typesetter will output are rarely the same, and therein lies the greatest problem in communication.

Word processors are designed to make page formatting and text manipulation simple. On the most useful systems, the screen display simulates the finished page format. When assembling a document you would arrange it on the screen as you envision it on paper. Headlines are centered,

paragraphs indented, copy justified, words highlighted or underlined, and charts and tables neatly typed. It sounds perfect, except to the typesetting operator for whom it spells chaos. The tab settings on a typewriter or word processor, for example, don't match those on a typesetter.

Typesetting Troubles

Imagine a customer approaching a typesetting operator with a 14-page carefully typed manuscript that contains pricing information about a product according to code number, description, color, unit price, number ordered, and total cost. This listing would seem to be easy to process. Told that the customer wishes to telecommunicate this from a PC, however, the operator is likely to develop a headache just thinking about all the inherent problems in such a job.

The most obvious problem is with the second category, "description," for there is no guarantee that the lines of text when typeset will break at the same points as they do in the manuscript. Because there may be less or more room available in that column, when transmitted, words left over must be manually moved up or down until everything fits correctly.

Another headache is bold headlines. Word processing programs, such as the *EasyWriter II*, produce boldface type by typing the same words twice, which are

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WRITING

sometimes offset a little from each other. While this works for typed copy, when it's sent to the typesetter it comes out on two separate lines and looks like a misprint. Needless to say a newsletter with scores of boldface subheads can cause problems.

You need to realistically consider whether a typesetting job is suitable for telecommunication. Jobs of one page or less are usually a waste of time: A good typesetting operator will have the job set and waiting while you're still fumbling with transmission protocol. Long text jobs are ideal for telecommunicating. The type shop can perhaps best judge whether the process will be economical.

Sending the Right Signals

Instead of formatting your job you can code it. Words are typically translated into ASCII (American Standard Code for Information Interchange) and are then sent into the typesetter, where everything is translated into the typesetter's hexadecimal codes. Thus the typed letter *W* arrives at the other end as an uppercase *W* and not a lowercase *w* or a plus sign (+). Unfortunately, though, it arrives with none of the information about size, weight, or type style that is needed to produce finished type.

You have, then, three major choices when transmitting data: Tell the operator to make the data "look nice"; transmit data and hard copy that indicates line lengths, font changes, sizes, leading and so forth; or do most (or all) of the coding yourself on your PC and transmit the disk to the typesetter along with marked-up hard copy.

If you chose either of the latter options, it's essential that you take time to educate yourself about typesetting. (Too many would-be publishers assume that having mastered the word processor, they know everything about typesetting.) A useful primer is International Paper Company's *Pocket Pal*. It provides information about typesetting, copy preparation, proofreading, and the graphic arts industry.

If you decide to use the coding method,

you will have to consult with the operator about which system to use. The choice will vary depending on the equipment used and the operator's preferences.

You'll need a translation table to transform the ASCII copy to typesetting codes. The standard alphanumeric characters should be handled automatically by the program, but some operator-defined translations should be available. For example, the *AM/CompEdit 5810* telecommunications program converts unfamiliar characters (anything that is not a letter or num-

You can't turn word-processed prose into typeset copy at the push of a button.

ber) to en spaces. Fortunately, the program includes a Script File to handle specific translation problems.

One problem that this resolves is that of open and closed quotes. On the IBM PC there is a single key for double quotes ("). The typesetter, however, uses two keys (') and ('). *CompEdit's* script file makes a determination based on the appearance of a word space in relation to the quotation mark ("). If it is preceded by a word space, it opts for open quotes, if followed by a word space, the opposite is true.

The script file also converts fractions into typeset fractions. There are, however, problems inherent to this process. If you enter a date as 1/23/84, the file will convert the first three characters into a fraction. And, more importantly, there is no guarantee that the typesetter even contains a fraction font.

The *CompEdit* system offers the use of a mnemonic code consisting of a dollar sign followed by two alpha keys and, occasionally, numbers. The typist can input these directly on the PC, but they require an exact knowledge of the typesetting fonts being used.

An alternative method would be to type a specific character, such as a less-than

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sign (<), that would later be translated into the necessary codes. You could either use your word processor's search and replace function to replace all the symbols after you've finished typing, or the translation table could do this automatically during transmission.

Special Characters

If you have many different special characters, for example, degree symbols, plus and minus signs, Greek characters, you will quickly run out of useful keys on the PC. Once you've used a key for a code, you eliminate its use as a normal key.

The best method I've found is to designate each special code with a caret (^) followed by two numbers. Give a list of code definitions to the type shop with your hard copy. This way the operator can include the codes directly in the translation table, or convert the code "01 to Data 01 (on the *CompEdit*) or user defined key 1 (on the *MCS/8400*). The operator can then fill that segment while the job is being set.

You can certainly facilitate the process by doing some modest coding. PC word-processing programs make no real distinction between a screen-line ending and a paragraph return. On a typesetter, however, it is crucial to make a distinction between a "hard" and a "soft" return to keep paragraphs from running together. A "quad left" or "flush left" code has to be inserted immediately before the final return in a paragraph. And you can help matters considerably by inserting a code at the end of each paragraph.

There is much you can do to make the transition from typed copy to typeset copy easier. Some typical problems and potential hazards have been outlined here, but unless your requirements are highly unusual, some kind of time-saving telecommunicating solution can almost always be worked out. The best moves you can make are to educate yourself about type and to work out a plan with your typesetting operator before you invest hours of typing time at the word processor. ■

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Training the Multitudes

The training series is designed for situations in which numerous people need to learn to use the PC. Possible sites are computer stores, computer training schools, and businesses. Later this year, MicroMentor will release tutorials on *1-2-3*, *dBASE II*, *Multimate*, and *WordStar*.

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Like interactive computer systems, interactive video training systems help people learn in several ways at once: by seeing, hearing, and doing. The addition of the videotape makes the images, soundtrack, and possible manipulations more realistic and sophisticated, Donahue emphasizes. Interactive video programs can accelerate learning by 25 to 40 percent; Donahue cites studies claiming that people remember 25 percent of what they hear, 45 percent of what they see and hear, and 70 percent of what they do.

Donahue has found that interactive video is more fully absorbing than video or computer-assisted instruction (CAI) alone. When he interrupts students at work on his *Personal Consultant* series to quiz

them about material, he says, "they just want to be left alone."

The *Personal Consultant* series, designed by Donahue, consists of three lessons on videotape and floppy disk: "Introduction to the PC"; "Using Programs" (lessons on word processors, spreadsheets, and database managers); and "Disk Drives and DOS" (a guide to formatting, copying, and using operating system commands).

When he designed the courses, Donahue first decided exactly what each completed lesson should accomplish. Working backwards from these objectives, he created a series of flow charts. These charts became lesson maps that outline a main menu and describe the videotaped material and computer exercises for each selection.

Such a menu-branching system makes this training truly interactive and different from the passive instruction of traditional audio-visual aids, Donahue says. With menus, students can focus on their own levels of expertise; if they know all about sections A, B, and C, they can opt to study D. To make the menus as effective as possible, Donahue spends much time second-guessing prospective students. "You have to anticipate what people might do wrong or where they might have problems in a given lesson," he explains.

Donahue's program design echoes oth-

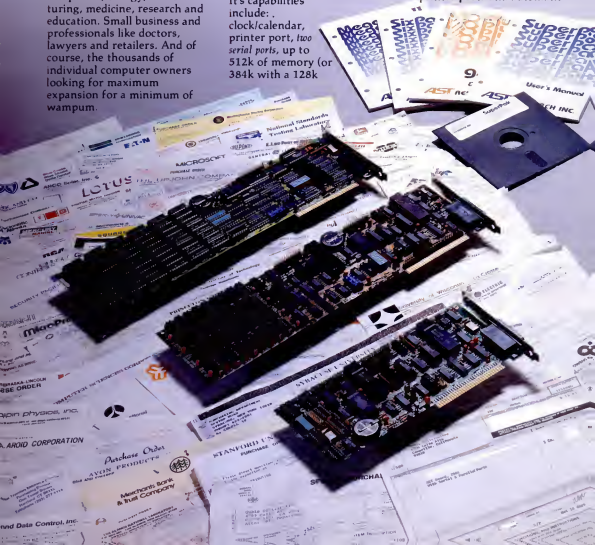
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er interactive video courses that allow students to choose among actions. Some police departments, for example, use interactive video systems to train rookie cops in how to handle dangerous situations. Another innovative system, designed by Brigham Young University (a leader in educational video), helps teach Spanish to high school students. Correct answers to questions posed in Spanish lead the students to a fiesta; incorrect answers spirit them off to jail.

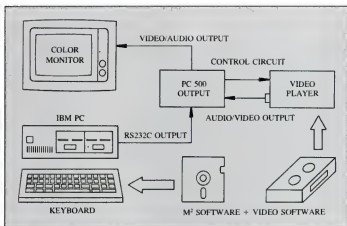
And like other CAI systems, Donahue's system gently urges the students to try again when they get the wrong answers and congratulates them when they do well. Since students work individually with the computer, they do not need to fear being humiliated in front of their peers when they make a mistake.

The series itself is simple to use. Once the disk is loaded into the PC, the student can sit back and relax as strains of Mozart softly accompany the introduction to the lessons. The student can set the program's skill level by taking a diagnostic quiz, and the amount of time he or she spends thereafter depends on individual speed.

Donahue designs his lessons to allow students to spend about a quarter of their time actually working on the computer. Typically, the amount of time required to complete each lesson in the *Personal Consultant* series is 2 hours, but it can range from 20 minutes to 3 hours, Donahue says.

Donahue, 43, has several education degrees and developed his teaching methods as a school administrator and computer training instructor. Using his own savings, he and two others launched his Minneapolis-based business in February, 1982.

Donahue believes the possibilities for computer-video interactive applications are limitless. The only reason the market has not taken off so far, he says, is cost. To produce a 1-hour tape, MicroMentor spends from \$100,000 to \$150,000, depending on how complex the lessons are.



This flowchart shows the hardware configuration necessary to run an interactive video system like *Personal Consultant*.

In addition to the PC, Donahue's system requires the following hardware:

- An industrial-quality videotape player. Standard home video recorder/players can't run interactive video because most switch from fast-forward to reverse mechanically. Industrial-quality players have solenoids, which perform the switching maneuvers electronically.
- A Sony KX1211 HG monitor, which adapts to either a composite (a regular television screen) or an RGB color input screen (like those used on personal computers), thus eliminating the need for the dual screens used by most other interactive systems.
- A Whitney PC 500 interface. This "black box" device (in this case, it is blue) connects the video player to the computer and to a color monitor. The interface was developed by Whitney Education Services of San Mateo, California, maker of the first microprocessor-based interactive video system. Whitney's interface generates operating code in BASIC.

An Enhanced Interface

Earlier this year, Whitney introduced a new, enhanced version of the interface that can be installed inside the IBM PC.

Donahue predicts that eventually every video player/recorder will have a computer interface built into it, thus making interactive video programs available to an even broader audience.

One advantage of the Whitney interface, says Donahue, is that it allows voice-over instruction to continue while the student works on computer exercises and the video tape rewinds. Delays while waiting for tape to rewind do not occur with video disks, which can be accessed at any point at any time.

The *Personal Consultant* training package sells for \$990, and a Whitney interface adds another \$990 to the bill. Donahue says that MicroMentor will also sell the interface to its customers, or advise them where to find the best prices on PCs and monitors.

The price may be high, but the system is still a bargain, Donahue asserts. All the employees in a single office with only one PC could be trained on the system in a month for far less than any other training program would cost. Interactive systems may seem too expensive for small school systems, but Donahue maintains that the system costs much less than a professional trainer.

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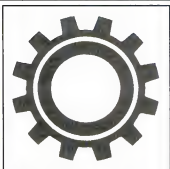
Database programs configured specifically for estimating construction job costs can give builders an edge. This is the third in a series of articles on how contractors can use PCs.

Although many contractors use spreadsheet programs to estimate costs and materials for a particular project, database programs offer a more powerful way of handling the estimating process. Such programs reduce the possibility of errors and omissions and generate bids that can be modified easily. Database programs allow the contractor to create and maintain price files of labor and material costs and to convert these figures into quantities needed for a particular job. In addition to the general programs, two types of database programs are designed specifically for estimating: question-and-answer and work-package.

The question-and-answer method is easy to use and requires little knowledge of estimating concepts. The work-package method is faster, but it requires advanced knowledge of construction systems.

Question and Answer

Basically, the question-and-answer method is for the estimator who is unsure as to the type of information he needs to enter into the computer in order for the program to generate the correct results. The question-and-answer dialogue takes you step by step through a series of questions about the job. Your answers elicit further, more detailed questions about a particular item or items. This process of determining the quantities of various



materials needed to complete a project is known as a "take-off."

A simple dialogue might run like this:

Question: What type of building is this? *Answer:* Concrete.

Question: What type of foundation do you want for the concrete building? *Answer:* Spread footing.

Question: What type of concrete should be used for the spread footing foundation? *Answer:* 3,500 psi.

After you have worked through all the questions and entered all the dimensions or quantities when prompted, the estimate is complete.

The main disadvantage of the question-and-answer method is its slow speed. The computer has to store so much information and there are so many steps that response

time is slow. Nonetheless, these programs are useful for training new estimators, and those with experience may benefit from the thoroughness of the question-and-answer format.

Work-Package Estimating

The work-package method is a much faster alternative. Programs that use this mode ask for quantitative data on a finished construction item and then automatically calculate quantities for all the basic elements needed to build the item. Some systems even compute all the items on-screen, at one time.

To illustrate work-package programs, which are also known as "assembly" programs, I'll use the example of a concrete wall. For every foot of wall of a given height, the program allocates, a certain amount of reinforcing steel, formwork, concrete, labor, and so forth. You simply enter the total linear feet of wall, and the program uses preset factors to compute the totals of the various items, including profit and overhead percentages, if desired.

Programs that perform work-package estimating on microcomputers are available starting at around \$1,000. But before shopping for a work-package type of program, you should check on how difficult it will be to set your own specific work-package factors on it and make sure the number of items in each individual-work

package is sufficient for your needs.

The Best of Both

Some of the most sophisticated esti-

mating programs offer the best of both worlds. These programs were previously designed only for minicomputers and are just beginning to become available for the

PC. On these programs, the question-and-answer mode is set up by the estimator who enters the questions to be asked about every job. The work-packages are drawn from item-cost files that can be searched by item type (for example, concrete), spe-

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The work-packages are drawn from item-cost files that can be searched by item type, specific item number, and vendor.

cific item number (say, 2,000 psi concrete), and vendor (say, Joe's Concrete Company).

These combination programs also permit a number of estimators to work off the same machine simultaneously. The user can insert a 20-character memo to be called up along with an item to keep notes or questions in front of the estimator performing the take-off. The take-off can be performed on each item by total quantity, and the computer automatically figures the number of standardized units needed.

Dedicated Estimating Systems

There are several software/hardware packages on the market that are especially designed for estimating. They attempt to automate as much of the estimating process as possible. On some systems, the contractor sends lists of his categories and prices to the vendor to be preprogrammed before delivery of the system. The computer has a small keyboard with preprinted overlay guides, which allow the estimator to choose the category of the take-off. Data may be entered using the keyboard or a hand-held probe. Prices for these systems start at \$10,000 and they have specialty item-cost files, such as electrical, mechanical, or HVAC. (Heating, Ventila-



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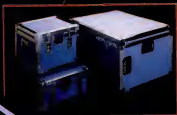
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Choosing an Estimating System.

The size of the cost file as well as the size of the estimates to be performed must be taken into account when choosing an

two before refusing to alter your present methods. You may find that the computer eliminates work you used to do manually, so you don't really need all the functions

you thought you did. You'll be better off customizing an existing program rather than designing your own. "There's no point in reinventing the wheel!" ■

You may find that the computer eliminates work you used to do manually, so you don't really need all the functions you thought you did.

estimating system. For large jobs with thousands of items, you may need a computer system with enough storage capacity to hold a cost file of 50,000 items, in addition to the estimate you are creating. Multiuser capability is a factor, too. Larger companies may want to create a central database that can be accessed by several estimators. A networked PC configuration would also be ideal for this type of application.

Some systems let you perform the take-off in your office on a PC and then access a commercial database through a phone line hooked into the computer via a modem. The database might be accessed for prices only, or the take-off data could be uploaded to the mainframe. The finished estimate could be returned via modem.

Another important consideration when choosing a software package is its level of customization. How closely do you want your estimating program to be tailored to your company's specific estimating needs? Remember, customized programs are expensive, and you may outgrow the system.

It's better to accept that your present estimating methods may need to be modified. You should at least try a program or

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Playing the Market With a PC

Individual investors are turning to their PCs for advice and adding up their profits with a growing variety of hardware, software, and on-line services for portfolio management.

All business and professional disciplines have been affected by the proliferation of microcomputers, but perhaps none has benefited more than the area of financial investing and investments. Investors have been in the vanguard in using micros to support decision-making, and they have also been among the most vocal of users both in popularizing the use of micros and in demanding improvements in the software they use.

The micro's most helpful contribution to investors has been to eliminate the clerical tedium of gathering market information. Now, with commercially available software, a microcomputer can:

- value a portfolio of 100 securities in less than 5 minutes.
- call to the user's attention all articles on a certain subject that have appeared in the *Wall Street Journal*, *Barron's* and on the Dow Jones News/Retrieval Service within the last 90 days.
- obtain the high, low, close, and volume for the last 120 trading days for a specific security within 15 minutes.
- obtain a synopsis of a firm's most recent 10-K filing within 2 minutes.

Tied in directly with the decrease in clerical time is an increase in clerical accuracy. Stock prices can be entered into the system either by user input or through any on-line service that provides automatic pricing. Once the correct price for a secu-



rity position has been obtained, the computer's valuation of the position and the determination of profit or loss will be correct. There is no chance of error. If the price and volume information for a security has been collected, any computer-generated graphs of the security's performance or any moving average calculations will be accurate.

Foremost in investors' minds, however, is the fact that a computer's speed and accuracy puts mountains of useful financial information at their disposal.

Without the help of a computer, a technical analyst might manage to follow the ups and downs of 12 stocks. Now, information on 225 securities is at his fingertips, including calculations never previously thought practical.

Access to information through micro-

computer systems can also be viewed as a small step in democratizing the securities marketplace. The individual investor can now access information that was formerly available only to a privileged few at brokerage firms. Although "insiders" can still get financial information that's not available to the public, the trend is to provide individual investors easier access to more facts and figures than ever before.

The quality of the software and services available to investors is constantly improving. An example of this continual maturation of available products is the portfolio accounting area. In 1978, Apple Computer, Inc., in conjunction with Dow Jones & Company, introduced an Apple II program called the *Dow Jones Portfolio Evaluator*. The program automatically priced a portfolio via modem, calculated market value, and determined unrealized long and short term gains and losses. As a portfolio management program, though, it was not very good for a number of reasons:

- It maintained only net positions (not individual tax lots);
- It maintained only unrealized items (not closed transactions for Schedule D tax reporting);
- It was designed to utilize a 40-character print line, which required a great deal of paper-shuffling as the user contended with twice as many pages as would have been



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necessary had an 80-column format been used;

• Even if the same security was held in more than one portfolio, the *Portfolio Evaluator* required the computer to obtain the same price again and again—as the clock ticked away and the bill for Dow Jones' on-line pricing added up.

In spite of these deficiencies, the program was mind-boggling at the time it was

introduced. A portfolio manager could value his holdings almost instantly at 4:15 p.m., print out the profit and loss reports at 4:30, and scan them on the way home from work.

But this was just the beginning—soon software firms jumped into the market. New portfolio management systems not only eliminated the deficiencies in Apple's *Portfolio Evaluator*; they also added many

On the Market

A listing of some of the investment programs now available to PC users.

Dow Jones Market Analyzer

Dow Jones & Co., Inc.

P.O. Box 300

Princeton, NJ 08540

(800) 257-5114

(609) 452-1511

List Price: \$349

Requires: Asynchronous communications adapter with RS-232C-compatible modem, Advanced BASIC color graphics adapter card. With DOS 1.1, 64K RAM and single-sided disk drive; with DOS 2.0, 128K RAM and double-sided disk drive.

CIRCLE 736 ON READER SERVICE CARD

Roslyn, NY 11576

(800) 645-3120

(212) 895-3810

List Price: \$695

Requires: 128K RAM, double-sided double-density disk drive.

CIRCLE 738 ON READER SERVICE CARD

PEAR Technical Analysis

Hale Systems, Inc.

1044 Northern Blvd.

Roslyn, NY 11576

(800) 645-3120

(212) 895-3810

List Price: \$1,495

Requires: 320K RAM, double-sided double-density disk drive, modem.

CIRCLE 739 ON READER SERVICE CARD

The Market Analyst

Anidata, Inc.

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Pennsauken, NJ 08110-4010

(609) 663-8123

List Price: \$495

Requires: 128K RAM, PC color graphics card, modem.

CIRCLE 737 ON READER SERVICE CARD

Reveal Portfolio and Client Management System

Reveal Software, Inc.

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Jericho, NY 11753

(516) 935-2000

List Price: \$1,550

Requires: 128K RAM, two double-sided disk drives.

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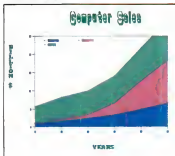
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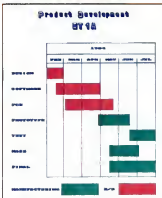
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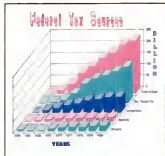
**LINE CHARTS
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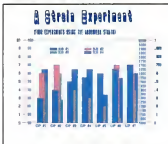
**GANNT CHARTS
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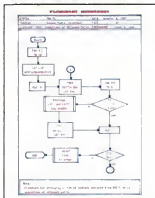
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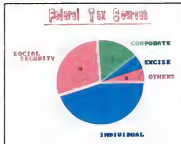
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Within each group, there are further subdivisions. For example, systems for technical analysis include Anidata's *Market Analyst* and Dow Jones' *Market Analyzer*, which provide basic tools for the end user to perform market analysis. Additionally, there are programs that support specific technical theories in investing.

There are also some common denominators among the various categories. For instance, most portfolio, technical, and fundamental systems require external data, which is usually available electronically from a remote database such as Dow Jones, Warner Computer Services, DRI, The Source, or CompuServe. ■

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Graphing Medical Statistics

Health care professionals can save themselves time, money, and aggravation by using a PC to produce graphs for slide presentations. Here are some tips that will help them do it right.

What are the top ten causes of death in the United States? How much has the average life expectancy increased since the 1800s? How does the number of motor vehicle deaths vary with age and sex? At the present rate of growth, what will be the world's population in the year 2100? Is the number of women dying of lung cancer increasing?

These are the kinds of statistical questions health care professionals may often be called upon to answer at professional meetings with colleagues, when teaching classes, or in front of local organizations. An IBM PC can help you make your point dramatically, with impressive, eye-catching presentations. Color monitors and multicolor plotters can generate dazzling output, and even a black-and-white monitor and dot-matrix printer can get your message across graphically.

Before I owned a PC, putting together a few slides for a lecture was a tedious and time-consuming project. I'd have to graph my data by hand, send my rough drawings to a scientific illustrator to have the final graphs drawn, and then have slides or overhead projections made from the drawings. If all went smoothly, this process would take 2 weeks.

Now, I simply enter the data into my PC, type the labels for the title and the axis, and then photograph the video screen, or use a screen camera (see "Pho-



to Replay: Making Slides From Your PC" and "Screen Gems: From Monitor To Film," *PC Magazine*, Volume 2 Number 3). At the heart of the whole process are programs that can plot equations and convert tables of data into bar graphs and line graphs.

A myriad of programs are currently available for plotting and manipulating data on the PC; several of these programs are attractively priced. But for my own work, I've written a series of plotting routines that create bar graphs and scatter plots and do simple curve fitting. These programs satisfy most of my data-handling needs. (These programs are available to interested readers. To obtain a single-sided disk, send a \$30 check to me at 36 Dove Drive, Ithaca, NY 14850.)

What follow are some examples that

demonstrate a few ways to present health care data and some tips on writing simple programs for data plotting.

Making Graphs

Most statistical information can be presented quite simply in the form of a bar graph or a scatter plot. Nearly everyone is familiar with this manner of presenting data, and most often you can make your point clearly and succinctly by sticking to these formats. Figures 1 and 2, which illustrate the average life expectancy in Western Europe from 1830 to 1980, show the same data presented two ways. In this particular case, I feel that the bar graph is more aesthetically pleasing. If, however, you wish to add more information to the figure, such as by fitting a curve to it, the simpler line graph of Figure 1 might be more appropriate. Always beware, however, of trying to put too much information into one graph. What may be clear to you, if you have seen the figure many times, may be rather obscure to the viewer when the graph is flashed on the screen.

Curve fitting adds another dimension to the presentation of data. Figures 3 and 4 show the United States population from 1790 to 1960 with two possible curves superimposed on the scatter plots. Figure 3 shows the simplest "curve," a linear regression line calculated by the least-squares method. Linear regression fits this

data poorly because populations do not increase arithmetically. The logistic growth curve of Figure 4 is a much better fit. Such a curve allows you to make rea-

According to a 1979 study, nearly 13 percent of girls between the ages of 12 and 18 were smokers, a 2 percent higher rate than for teenage boys.

sonable extrapolations about what the future population may be. Notice, however, that even this logistic growth curve is a poor fit for the data in the years 1950 and 1960, as it predicts that the United States population will never exceed 184 million. The actual 1970 population exceeded 200 million, due in part to the post-war baby boom and to improved health services, factors that didn't exist when this study was done (prior to 1950).

Finally, Figure 5 shows a somewhat fancier bar graph that uses differently shaded bars to demonstrate a major health problem, lung cancer. The graph shows the age-adjusted lung cancer death rates in the United States per 100,000 people. The

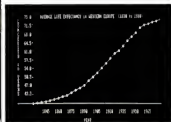


Figure 1: A simple line graph of the life expectancy statistics.

data covers the years 1930 to 1980 in 5-year intervals and shows the death rate separately for men and women. The rate of death from lung cancer is steadily increasing. Although the incidence of the disease is much greater in men than in women, the lung-cancer death rate in women is also rapidly rising. This rise most likely reflects the increase in smoking by younger women. According to a 1979 study, nearly 13 percent of girls between the ages of 12 and 18 were smokers, a 2 percent higher rate than for teenage boys. This statistic shows a marked change from the 1950s to mid-1970s period, when girls were less likely than boys to start smoking and those who did started at a later age. By the late 1980s, lung cancer is expected to replace breast cancer as the number one cancer killer in women.

Writing a Program

So much for the health statistics—how does one go about writing a plotting program? Such programs are fairly simple to write using the many graphics commands

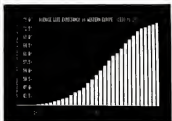


Figure 2: The same statistics that appear in Figure 1, done as a bar graph.

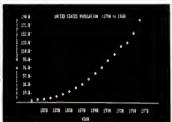


Figure 3: A regression line fitted to scatter-plotted population statistics.

available with IBM BASIC. The CIRCLE function allows you to draw data points of various sizes anywhere on the screen. The LINE function allows you to connect data points and can also draw rectangles of any size, filled in with any color—an ideal way to draw bars for bar graphs.

The aspect of graphics programming that I have found to be the trickiest is outputting the data neatly on the screen. Doing so entails a series of routines that can scale the axis to fit your needs. You want to be able to expand or contract any part of the graph to focus upon or magnify data that interests you.

Finally, it is nice to be able to label the axis as you wish and include details such as the title of the graph or an explanatory key to help the reader understand what you are trying to say. Each graph should be self-explanatory. While these details are a lot for you to keep in mind, once you have your plotting program up and running, you are unlikely ever to go back to using rulers, pencils, and graph paper. ■

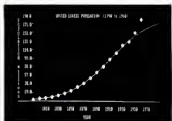


Figure 4: The Figure 3 statistics fitted with a logistic growth curve.

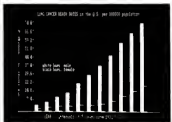


Figure 5: A bar graph showing death rates from lung cancer among men and women.

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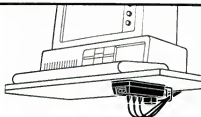


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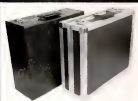
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Each of the board's two serial ports can be assigned to any unused I/O address. A utility program is provided to allow selection of baud rate, number of data bits, number of stop bits, and parity for each port. Another utility with the board permits the Consocard to automatically set the time and date within a user's system as the system is powered up. The clock/calendar can also be used as an

alarm or periodic time-out clock.

(List Price: \$395-\$895, depending upon RAM)

Consolink Corp.

1840 Industrial Cir.
Longmont, CA 80501
(800) 525-6705

CIRCLE 797 ON READER
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SOFTWARE

Energy Engineering Software

A series of six programs designed to aid engineers involved in the design and analysis of energy systems. The programs, *DATAFIT*, *STEAMCALC*, *COMBUSTION*, *HEATFLO*, *FLUIDFLO*, and *COGEN*, are menu-driven and feature input data-checking in cases

where it is feasible.

DATAFIT performs a regression analysis on user-supplied data to determine the best-fit equation for each of seven types of distribution: exponential, square root, power, inverse, linear, logarithmic, and polynomial. The program analyzes data sets as large as 500 points, and allows users to perform any number of interpolations.

STEAMCALC computes individual values of thermodynamic steam properties over a wide range of temperatures and pressures for subcooled, saturated, and superheated conditions. Equations contained in the program are an adaptation of those recommended by the ASME and produce



Solidrive Disk Emulator, Targa Electronics

SOFTWARE

thermodynamic values that agree closely with ASME steam tables.

COMBUSTION computes combustion efficiency of industrial and utility boilers based on the molar method, patterned after standard ASME performance test codes for combustion testing. Combustion systems using all standard fuels can be handled, and those using special fuels such as wood-wastes or other industrial byproducts can also be handled by entering their specific chemical and thermal characteristics. This program provides the user with an option of several levels of detail in the output report, ranging from a simple mass balance to a comprehensive report detailing all energy losses. Flue-gas losses are listed with both sensible and latent-heat-loss components, as well as losses associated with unburned combustibles.

HEATFLO computes heat losses from pipes and other surfaces. The program uses accepted engineering procedures for determining convective and radiative heat losses. Correlations of thermal conductivity as a function of temperature have been incorporated into the program for five types of commercial insulation: calcium silicate, fiberglass, polyurethane, mineral fiber, and cellular glass.

FLUIDFLO computes

the pressure loss and power consumption for a series of up to 70 sections of pipe. The Darby-Weisbach pressure loss equation is used, and the Colebrook equation is employed to compute friction factors.

COGEN performs a thermodynamic and financial analysis to evaluate the economic benefits of installing an in-plant co-generation system. It is designed to be used as a tool for determining the optimum size turbine/generator for the energy-demand characteristics of the plant.

(List Price: \$245-\$735, depending upon program)

Requires: 64K, two disk drives, PC DOS, MBASIC. Software Systems Corp. 5766 Balcones Dr., #203 Austin, TX 78731 (512) 451-8634 (512) 345-8052

CIRCLE 783 ON READER SERVICE CARD

File Clerk * Congress A specialized database, containing names, addresses, and detailed specific information for each member of forty of the most important congressional committees of the U.S. Congress. Data for each congressman includes office address, telephone, home town, committees, party, district, and reelection year.

The software provides the user with the ability to print mailing labels and ad-

dress form letters for specified sub-sets of Congress or by congressional committee. The Congress and Committee files may be updated or changed by the user, and may be listed on monitor, via printer, or transmitted over communications lines.

An annual update of the Congress and Committee files will be available.

(List Price: \$39.95/\$44.95 for 160Kb disk)

Requires: 64K, one disk drive, PC DOS.

Landrum Software, Inc. P.O. Box 842 Palm City, FL 33490 (305) 286-1324

CIRCLE 741 ON READER SERVICE CARD

Astrocalc

A program providing astronomical data for the sun, moon, and all planets. The user inputs date, time, and location in longitude and latitude. Output from *Astrocalc* includes: rising and setting times plus brightness magnitudes; right ascension and declination, altitude, and azimuth; ecliptic latitude and longitude, elongation from sun; mean and true anomalies, distances; local sidereal time, Greenwich mean and sidereal times; beginning and ending of twilight; Julian day number, solar equation of time.

The software's accompanying manual provides an explanation of the program, with example output, an in-

troduction to the fundamentals of positional astronomy, and references to other works in the field. All required output is available from the software's on-screen menus.

(List Price: \$29.95)

Requires: 64K, one disk drive, PC DOS. Zephyr Services 306 S. Homewood Ave. Pittsburgh, PA 15208 (412) 247-5915

CIRCLE 782 ON READER SERVICE CARD

FileLynx/3278

Terminal emulator software, permitting a user's system to interface with IBM mainframe systems. When used with the manufacturer's line of protocol converters, *FileLynx/3278* emulates a 3278-2 terminal, supporting all IBM function and cursor control keys. Used with a color monitor, the software features four-color 3279 terminal emulation.

The software also supports several different auto-dialing modems, including the Hayes Smartmodem 1200 series and Racal-Vadic VA212. By specifying the modem type and a phone number during the initial configuration of the software with the user's system, *FileLynx/3278* can automatically connect the user's system to the protocol converter at the outset of an operation, and can communicate all necessary prelimi-



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Pegasus systems are available only through dealers. So contact the dealer in your area who sells IBM PC or compatible computers. If he doesn't have Pegasus, chances are he'll carry it soon. Just ask him to call us. We will ship him your Pegasus unit immediately.

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2200 West Higgins Road, Suite 245
Hoffman Estates, Illinois 60195

Dealer Inquiries Invited

800-323-6836

In Illinois (312) 884-7272

SOFTWARE

nary communication parameters.

(List Price: \$200)

Requires: 64K, one disk drive, PC DOS, serial port, modem, Local Data protocol converter.

Local Data

2701 Toledo St., #706
Torrance, CA 90503
(213) 320-7126

CIRCLE 781 ON READER
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CompuMedic/VET

A veterinary office management system, consisting of a series of 60 integrated programs. All programs have an easy to use command format for producing useable screen displays. Features of the *CompuMedic/VET* system include the storage and retrieval of owner and animal records; Accounts Receivable; user-defined data fields; automatic updating of data fields upon posting of charges; a Report Generator, allowing for user-defined criteria and report formats; 22 standard reports; bank deposit slips; an integrated word processor; and practice analyses.

(List Price: \$3600)

Requires: 128K, hard disk, PC DOS 2.0, 132-col. printer.

Data Strategies, Inc.
P.O. Box 28726
San Diego, CA 92128
(619) 489-9218

CIRCLE 780 ON READER
SERVICE CARD



Turbo Pascal, Borland International

Turbo Pascal

A version of the Pascal programming language, providing fast execution speeds and a built-in full-screen editor compatible with word processing software such as *WordStar*. *Turbo Pascal* takes up only 28K of disk space, permitting the application program source code and compiled object code to be stored simultaneously in RAM.

During program compilation, *Turbo Pascal*'s cursor moves directly to identified errors and waits for corrections. At run-time, identified errors are referred to the source code. *Turbo Pascal*'s compiler produces object code (.COM files), and is written in assembly language.

(List Price: \$49.95)

Requires: 64K, one drive,

PC DOS or CP/M-86.

Borland International
4807 Scotts Valley Dr.
Scotts Valley, CA 95066
(408) 438-8400

CIRCLE 796 ON READER
SERVICE CARD

Professional Tax/Forecaster

A Federal income tax preparation program permitting analyses of different tax strategies. The program can print out data in a format similar to the 1040 form, but with slightly more information. Data for each tax strategy can be saved to disk under user-defined labels.

(List Price: \$99.95)

Requires: 64K, two disk drives, PC DOS.

Micromatic Programming Co.
Cedars Corners Sta.
P.O. Box 16735
Stamford, CT 06905
(203) 968-0933

CIRCLE 776 ON READER
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Calendar Plus

A time management program that can print calendar information in a monthly master calendar format, displaying all activities and their times for each day. *Calendar Plus* allows the merging of separately maintained calendars into an aggregate master. It can print a calendar for a selected range of activities, times, personnel, or locations. It



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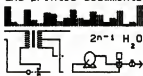
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SOFTWARE

also prints out calendar extracts in tabular list form.

The *Calendar Plus* master calendar can be up to 250 characters wide.

(List Price: \$300)

Requires: 128K, two disk drives, PC DOS, printer.

International Software Solutions

100 Peachtree St.
Atlanta, GA 30303
(404) 524-5330

CIRCLE 775 ON READER
SERVICE CARD

Sure-Wing C Compiler

A full C compiler with features including floating point, complete I/O support library, standard control structures, unions, typedefs, etc. Object code produced by this two-pass compiler is compatible with the PC DOS linker. Assembled subroutines can be linked in and called from C routines, and programs may be up to 64K of code and 64K of data. Source code is provided for all included library functions.

(List Price: \$100)

Requires: 128K, two 320K drives, PC DOS.

Sure-Wing Systems
P.O. Box 20008
Oakland, CA 94620
(415) 655-4773

CIRCLE 785 ON READER
SERVICE CARD



The Edge Series, Human Edge Software

The Edge Series

Three programs using artificial intelligence techniques to achieve a personal interface between the user and the software. The three initial product offerings, *The Management Edge*, *The Sales Edge*, and *The Negotiation Edge*, permit the user to communicate with the software in common English to reach solutions to business problems.

The Management Edge is designed to aid managers improve their supervisory skills. The user enters self-descriptive information by answering screen prompts. Also entered are data on the nature of the problem at

hand and profiles of other people involved. Using this data, the program can aid the user in resolving conflicts with personnel, improve communications within an organization, locate the proper position for an employee, determine the compatibility between the user and the organization, and develop an employee career plan.

The Negotiation Edge is designed to help the user develop a successful strategy for negotiating a contract. The program can be constantly updated with data on the course of the negotiations, and can respond with a modified strategy,

suggestions for changing one's bid or negotiating stance, etc. The software can also be used as a dress rehearsal prior to actual negotiations, producing different scenarios with their likely outcomes, to aid in choosing the optimum courses of action for the user to take.

The Sales Edge is intended to aid salespeople present themselves and their products to a prospective buyer in the most favorable manner. This is done by presenting the salesperson with a strategy that adapts his or her selling style to what the buyer requires. In particular, *The Sales Edge* suggests to

SOFTWARE

the user ways to describe the product to the potential customer. This allows the user to develop a step-by-step tactical plan to capture the client's attention, pitch the product, and close the sale.

(List Price: \$250 each program)

Requires: 128K, one 320K drive, PC DOS.

Human Edge Software, Inc.
2445 Faber Pl.

Palo Alto, CA 94303
(415) 493-1593

CIRCLE 792 ON READER
SERVICE CARD

CertiFLEX Accounting Series

A series of accounting programs written in Microsoft BASIC by Certified Public Accountants, for operation by persons with little prior

experience with personal computers. The available software modules in the series are:

- Accounts Payable with Checkwriting;
- Accounts Receivable with Billing;
- Inventory Control and Management;
- Payroll with Checkwriting; and
- Fixed Assets/Depreciation.

The software is menu-driven, and can support multiple company processing. The included user's manual provides a flowchart, tab indices, and descriptions of the reports produced by the programs.

(List Price: \$349 each program)

Requires: 128K, two disk drives, PC DOS.

Computer Program Associates
2526 Manana Dr.
Dallas, TX 75220
(214) 350-2361

CIRCLE 789 ON READER
SERVICE CARD

SuperDOS

A multi-user operating system allowing up to 10 dumb terminals to be linked to a host PC. SuperDOS also permits PC DOS programs to be run concurrently with SuperDOS software.

Applications available for operations under SuperDOS include *CPA, Medical Office, Legal Office, Manufacturing, Auto Rental, Van and Storage, Wholesale Distribution, and Word Processing*, as well as a general *Applications Generator* program. Most of the programs

were converted for SuperDOS from Data General-compatible Business BASIC software.

The initial SuperDOS package includes the system software, and an add-on board with serial and parallel ports, clock/calendar, and 256K of RAM. A three-system starter package is also available.

(List Price: Initial package \$2,500; three-system package \$10,000)

Requires: 128K, one drive, PC DOS, Superboard interface card.

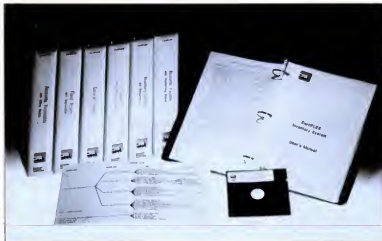
Bluebird Systems
6352 Corte Del Abeto
Carlsbad, CA 92008
(619) 438-2220

CIRCLE 788 ON READER
SERVICE CARD

MORT

A program to monitor on-line transactions of a PC used as an IBM 3278 terminal. The program operates independently of terminal emulator hardware/software packages within the user's system, and does not impact the performance of transactions between the user's system-as-terminal and the IBM mainframe.

MORT can report on transaction measurements including: think time, data entry time, response time, elapsed time, key count, and the number of transactions monitored. These items are reported on by total, minimum, maxi-



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SOFTWARE

mum, and average values.

Two versions of the software package are available, one providing only the communications software, the other including the IRMA communications board manufactured by Technical Analysis Corp. (List Price: With IRMA board \$2,495; software alone \$1,300)

Requires: 128K, two 320K drives, PC DOS, IRMA communications board. Automation Design, Inc. 350 N. Clark, #650 Chicago, IL 60610 (312) 670-2660

CIRCLE 787 ON READER SERVICE CARD

COPYLINK

A communications program permitting high speed data transfers of text and program code between dissimilar computers and operating systems. The *COPYLINK* program also provides access to commercial databases and TELEX/TWX networks, allows for unattended operation, and can emulate both smart and dumb terminals.

Among the software's distinguishing characteristics are modem speeds up to 1200 baud, the ability to receive more than one disk's worth of data, and single keystroke operation of functions such as electronic



COPYLINK, U.S. Digital Corp.

mailbox access. *COPYLINK* utilities support data transfers between different disk formats, as well as between the PC DOS and CP/M operating systems.

Error detection facilities include a CP/M error recovery technique with PC DOS extensions, preventing loss of data through unintentional exit from the program or by disk overflow during file transfer. Other features of *COPYLINK* include support of smart modem capabilities such as auto-dialing/answer, autologging, full- and half-duplex operation, XON/XOFF protocols, and a hardcopy option permitting printing of screen data.

COPYLINK also permits direct wire transfers of data at rates up to 19,200 baud. (List Price: \$99.95)

Requires: 128K, one disk drive, PC DOS.

U.S. Digital Corp.
5699-D S.E. International Way
Milwaukie, OR 97222
(503) 654-0668
Telex: RCA 29 6537

CIRCLE 795 ON READER SERVICE CARD

Ratercalc

A commercial lines insurance rating system, permitting insurance companies and agencies to automate the rating procedures for developing quotes on commercial insurance coverage. Regularly updated versions of the software incorporate the current rates provided by the Insurance Services Office (ISO) of each state. *Ratercalc* is also modularized, permitting customization for non-standard ISO ratings or an individual company's needs.

Ratercalc features a multiquote facility for "what if" analyses about changes in coverages, limits, or

rates. With this feature, a user can produce policy quotations at varying deductibles, limits, or other criteria to tailor a price to a policy-holder. The program is menu-driven, and uses highlighted keywords as prompts. Printouts from the program can produce an audit trail showing all of the rates, factors, and equations used to compute premiums. (List Price: available from manufacturer)

Requires: 192K, two disk drives, PC DOS. AIRS, Inc. 1250 E. Diehl Rd. Naperville, IL 60540 (312) 369-2121

CIRCLE 790 ON READER SERVICE CARD

PAS Personal Accounting System

A template for the Lotus 1-2-3 spreadsheet program, providing users with a method of maintaining personal accounting data. Checks and deposits are entered into the same journal. The *PAS* software then posts the entries into an income and expenditure statement, reconciles book balances to bank balances, and summarizes by account number all checks and deposits.

PAS functions are menu-driven, and the system permits over 2000 items, depending upon the amount of memory available in the user's system. Other fea-

SOFTWARE

tures of the template program include error-trapping facilities.

(List Price: \$29.95)

Requires: 128K, two disk drives, PC DOS, Lotus 1-2-3.

Easy-As... Inc.

36 S. Charles St., #302
Baltimore, MD 21201
(301) 539-5540

CIRCLE 784 ON READER
SERVICE CARD

Set-FX

A printer control program written in assembly, designed to allow Epson-FX-80 and FX-100 printers to print the complete IBM PC character set, including line graphics, foreign languages, and math and science symbols. The software also permits convenient setting of Epson FX printer modes. Condensed, emphasized, proportional, italics, and other print features can be set by selecting options from a menu.

SET-FX includes a custom font generator, which allows a user to design fonts, adding to or changing the standard Epson range. Several pre-set fonts are provided by the software initially, and special fonts can be printed at the printer's rated speed of 160 characters per second.

(List Price: \$59.95)

Requires: 64K (PC DOS 1.1), 96K (PC DOS 2.0),



Set-FX, SoftStyle, Inc.

one disk drive, Epson FX printer.

SoftStyle, Inc.

7192 Kalanianiaole Hwy.
Suite 200
Honolulu, HI 96825
(808) 396-6368

CIRCLE 791 ON READER
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VidPrint

A screen dump print utility with text and graphics modes, which can produce printouts on SILENT/SCRIBE printers. When used in the text mode, the user can print underlined characters. In the graphics mode, high resolution print-

outs of screen images can be produced using the SILENT/SCRIBE, or WORD/SCRIBE printers, with dot matrices of 72 x 72 dots per inch and 144 x 144 dots per inch.

Other features of VidPrint include the automatic conversion of 40 characters per inch to 80 cpi, conversion from color screen presentations to gray shades on the printer, and future capability for color printouts using a DP-9725A COLOR/SCRIBE printer.

(List Price: \$29.95)

Requires: 64K, one disk

drive, PC DOS, Anadex printer.

Anadex, Inc.

9825 DeSoto Ave.
Chatsworth, CA 91311
(213) 998-8010
TWX: 910-494-2761

CIRCLE 774 ON READER
SERVICE CARD

Siege of Planet Houston

A multilevel, attack and conquer adventure game. The game's screen action progresses from deep space to the planet's surface. *Siege of Planet Houston* features color graphics and keyboard control. The game

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A screen generator program capable of creating menus and data entry screens for BASIC, dBASE II, and PC DOS 2.0. BASIC generation includes such features as color, reverse video, non-display, as well as bright and blink screen attributes.

Used with dBASE II, MAP/Generator can create .FMT (FORMAT) files for menus and data retrieval. In addition, the software can make use of ASCII characters 128 through 255, permitting more attractive looking screens.

(List Price: \$98)

Requires: 64K (PC DOS 1.1), 96K (PC DOS 2.0), one disk drive.

Lambda Associates
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A screen formatting program with text/graphic mode capability. The software permits the user to create, modify, and "paint" data entry screens. Screen attributes possible with the program include high intensity, blink, underlining, and inverse video.

(List Price: \$39.95)

Requires: 128K, one disk drive, PC DOS, compiled BASIC.

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(List Price: \$295)

Requires: 256K, two disk drives, PC DOS.
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Other features of the software include the ability to hold several print jobs in the buffer to be printed sequentially, to stop printing at any time in order to print high-priority jobs, and audible error-condition indication.

(List Price: \$50)

Requires: 64K, one disk drive, PC DOS, serial or parallel port, printer.
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(List Price: \$395)

Requires: 128K, two 320K drives, PC DOS.

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The *OPTIMUM Executive Series* program includes an on-screen tutorial, menu screens, and enhanced on-line help screens.

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Requires: 64K, two 320K drives, PC-DOS or CP/M-86.

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Requires: PC DOS 1.1: 64K, PC DOS 2.0 128K; one disk drive.

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Requires: 128K, one disk drive, PC-DOS, BASIC.

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PCLIFE—The Game of Cell Birth/Death

A game program, reproducing the life/death and regeneration cycle of a colony of one-celled organisms. The user provides the initial cell pattern—the game then carries that pattern through succeeding generations, following the laws of cell genetics. Within the game's "environment," cells may die before reproducing if they are too isolated from other cells, or if the "environment" becomes too crowded. As *PCLIFE* applies the rules of cell birth, kaleidoscopic designs emerge. While some patterns stabilize quickly, others can require hundreds of generations to settle down into a fixed pattern or into a repeating set of patterns.

The game can be used with IBM monochrome displays, or with color monitors to develop patterns in seven colors. Other features of *PCLIFE* include single steps forward/backward in time; an easy-to-use draw mode; and speeds up to 15 generations per minute.

(List Price: \$24.95)

Requires: 64K, one disk drive, PC-DOS.

PC-WARE

Dept. PCM2

P.O. Box 3174

Gaithersburg, MD 20878

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SR-LIB

A software research library management program, allowing the user to create and maintain a library of software modules compatible with the PC-DOS linker. *SR-LIB* can add or delete modules from the library, as well as replace modules with newer versions.

Using module libraries eliminates the need for the user to keep track of, and explicitly list, the procedures called for within an application. *SR-LIB* provides a special index of public symbols which can be searched quickly by the PC-DOS linker to resolve external references.

(List Price: \$29.95; manual alone \$10)

Requires: 64K, one disk drive, PC-DOS.

Software Research

P.O. Box 10004

Austin, TX 78766

(512) 346-5097

CIRCLE 752 ON READER SERVICE CARD

dPROGRAMMER

An applications generating program for users of *dBASE II* database management software. The program provides a method for developing debugged, ready-to-use applications quickly. It constructs data files and formatting information on-screen, allowing data to be entered as required by the user. Retrieval and use of data is provided by an imposed

SOFTWARE

menu-driven structure, including functions to list data on the screen in a pre-defined format, reports to be sent to a printer, and the retrieval of individual records.

All of **dPROGRAMMER's** functions are directly accessible through menus which are defined by the user through a question and answer format.

The **dPROGRAMMER** package includes an integrated accounting program. This module can handle all standard general ledger functions, including the preparation of balance sheet and income statement reports. The module is furnished with its **dbase II** source code, allowing users to incorporate the accounting functions with other applications.

(List Price: \$295)

Requires: 64K, one 320K drive, PC-DOS, **dbase II**.

Sensible Designs

5244 Edgemark Way
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I.M.P.A.C.T.

A program for insurance brokers or underwriters faced with the task of pricing catastrophe policies. Given the base year written premium, the policyholder surplus, and the estimated income for the coming year, the software can calculate the subject premium, the

payback in years, company retention expressed as percentages of estimated premium and policyholder surplus, and the cost of the catastrophe coverage per thousand dollars of coverage.

I.M.P.A.C.T., an acronym for **Interactive Management Pricing Aid for Catastrophe Treaties**, allows the user to vary the limits, retention, primary layer, and the premium rate factors for comparison results. Output can be printed out or stored for later recall.

(List Price: \$495; demo disk \$25)

Requires: 128K, one disk drive, PC-DOS.

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(List Price: \$795)

Requires: 320K, two disk drives, PC DOS, 8087 Math Co-Processor chip. **SPSS Inc.**

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Two software packages that implement the National Bureau of Standards Data Encryption Standard (DES). **u-PSYPHER** is a file-oriented, interactive program for the DES encryption of MS-DOS (PC-DOS) files. Applications of the program include secured files shared on disk, diskettes kept in unsecured areas, and files to be batch communicated via electronic mail or other networks.

DESCRIPT/MS software are fully documented assembler source code modules that may be integrated into realtime applications and generalized encryption or

authentication devices. Both module sizes and throughput requirements may be specified by the user.

(List Price: **u-PSYPHER** \$99; **DESCRIPT/MS** with sample calling program \$1,500)

Requires: Both programs: 32K, one disk drive, PC-DOS.

Prime Factors
6529 Telegraph Ave.
Oakland, CA 94609
(415) 654-5090

CIRCLE 750 ON READER
SERVICE CARD

UTIL

A general purpose utility program for the PC/XT. **Util** provides a user with the ability to sort directories; a simple database facility; keyboard redefinition tools; plus screen switching, and other useful functions. The sorted directory facility presents the user with a full-screen, alphabetically sorted directory. With a single keystroke, the user can resort the directory by date or extension, or print, browse, delete, copy, edit, or run a user-defined function on any file the cursor is pointing to.

Editing and word processing can be accomplished through the use of a text editor or word processing program. When browsing a file, the operator can use the PgUp and PgDn keys to move through the file. In addition, the browse function allows the user to mark

A portable computer needs a portable surge suppressor. The PC Saver™ line cord.



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CIRCLE 508 ON READER SERVICE CARD

SOFTWARE

any two points within a file and dump the marked portion to a printer.

(List Price: \$15)

Requires: PC/XT: 128K, one disk drive and Hard Disk, PC DOS 2.0.

Mutant Software

Program UTIL

P.O. Box 765

Bellaire, TX 77401

CIRCLE 771 ON READER
SERVICE CARD

SL-MICRO

A statistics program that can process large data files containing up to 32,000 cases with 200 variables. The program features Frequencies, Crosstabs, Condescriptive, Multiple Regression, and Pearson Correlation calculation abilities.

SL-MICRO is compatible with many database management systems, and is capable of producing five Frequency Tables for 30,000 cases in under 25 minutes. Variable and Value Labels, as well as Missing Values, are included.

(List Price: \$250)

Requires: 128K, two disk drives, PC DOS or CP/M-86.

Questionnaire Service Co.
Box 23056

Lansing, MI 48909
(517) 641-4428

CIRCLE 747 ON READER
SERVICE CARD

SAVVY PC

A database management system integrated into a

high-level programming language and operating system. The **SAVVY** programming language uses adaptive pattern recognition to interpret and learn user commands and command styles, rather than forcing users to adhere to strict machine conventions. For example, the "Figure a Loan" command can respond to "Figure Loan," "Figure the Loan," "Calculate a Loan," or any similar command that produces a recognizable pattern for that command.

Users can also modify commands to suit personal style by using an "Associate" command, which permits the user to teach the computer other ways to interpret a command. In cases of an invalid command, **SAVVY** displays messages that guide the user to a correction.

Other highlights of the database management system include numerical precision to 63 decimal places, time and date monitoring, and commands for control of video attributes.

(List Price: \$395)

Requires: 64K, two 320K drives.

Excalibur Technologies Corp.

800 Rio Grande Blvd. N.W.
21 Mercado
Albuquerque, NM 87104
(505) 242-3333

CIRCLE 770 ON READER
SERVICE CARD

The Superex Retailer

A point-of-sales inventory management program for small to medium retail businesses. The software allows a user to replace a cash register with a personal computer capable of issuing sales receipts, updating inventory, tracking back orders, generating invoices, and tracking receivables.

The Superex Retailer can also create receiving reports, calculate sales receipt totals, automatically add new customers to a mailing list, and keep track of sales per item or sales per salesman.

A software-controlled cash drawer that will interface with a user's system will be released in the near future.

(List Price: Floppy Disk version \$300; Hard Disk version \$450)

Requires: 128K, two disk drives (Floppy version) or Hard Disk and one drive (Hard Disk version), PC-DOS.

Superex Business Software
151 Ludlow St.

Yonkers, NY 10705

(914) 964-5200

CIRCLE 748 ON READER
SERVICE CARD

PC-XTRACT

A FORTRAN programming aid capable of scanning a program source code file, creating individual source code files for each main program and subroutine, function and blockdata. In

addition, **PC-XTRACT** produces an alphabetized batch file containing the name of each function extracted, for subsequent single command compilation with either the Microsoft or Supersoft FORTRAN compilers.

The user can specify automatic operation (where each routine is extracted and the output file automatically named with the name of the routine as the filename, plus a common user-defined extension), or manual mode (where the user may browse through the program and select which routines are to be extracted, naming each one as they are selected).

(List Price: \$49)

Requires: 87K, one disk drive, PC DOS 1.1 or 2.0.
StratCom Systems Inc.
1010 Turquoise St., #242
San Diego, CA 92109
(619) 488-2262

CIRCLE 748 ON READER
SERVICE CARD

DATACT/PC

An integrated accounting system for the PC/XT, composed of four modules: *Timekeeping and Billing*; *Internal Management Reports*; *Integrated General Ledger*; and *Tickler*, a time and project scheduling program. **DATACT/PC** allows a user to identify clients by name, with up to 99 projects permissible per client. Other features of the software package include

SOFTWARE/ACCESSORIES

access security control.

(List Price: \$4545; individual modules range from \$395 to \$2,395)

Requires: PC/XT: 128K, Hard Disk, PC DOS 2.0.

Data Law Co.

6950 S. Tucson Way
Englewood, CO 80112
(303) 790-8193

CIRCLE 769 ON READER
SERVICE CARD

ACCESSORIES

PC Saver

A surge suppression device, designed as a replacement power cord for a user's main system component. All surge suppressing/line filtering circuitry conforms to standards established by the Institute of Electrical and Electronic Engineers (IEEE) and the Underwriters' Laboratories (UL).

(List Price: \$49.95)
Kensington Microware Ltd.
919 Third Ave.
New York, NY 10022
(212) 486-7707

CIRCLE 765 ON READER
SERVICE CARD

Bit Banger

A foam-headed mallet with plastic handle, useful for relieving a bit of computer frustration without harming a computer system. The mallets are compatible with all makes, types, and models of computers.

The 13½-inch Bit Bangers include a Bit Banger Hanger, permitting convenient



PC Saver, Kensington Microware

mounting near a user's system, and an instruction book. The instruction book outlines, with graphic illustrations, the range of computer problems for which the mallet may prove a useful remedy.

(List Price: \$14.95)

Bits & P.C.'s

1850 Union St., #490
San Francisco, CA 94123
(800) 227-3900
(800) 632-2122 in Calif.

CIRCLE 768 ON READER
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PC Station

A workstation, featuring an all-in-one design placing all the components of a user's system within easy reach. The unit has a sliding shelf for the systems unit, a print-

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312/472-6659



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CIRCLE 391 ON READER SERVICE CARD

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The Rixon® PC212A offers you the only 300/1200 BPS full duplex card modem with auto dial and auto answer that plugs directly into any of the IBM PC® * card slots. Because the Rixon PC212A was designed specifically for the IBM PC, it is loaded with user benefits.

The PC212A eliminates the need for an asynchronous communications adapter card and external modem cable, this alone saves you approximately \$190. The PC212A provides an extra 25 pin EIA RS232 interface connector, a telephone jack for alternate voice operation, and a telephone line jack for connection to the dial network.

Without question, the PC212A is the most user friendly, most reliable, and best performing modem for your IBM PC. An internal microprocessor allows total control, operation, and optioning of the

PC212A from the keyboard. A user friendly HELP list of all interactive commands is stored in modem memory for instant screen display. Just a few of the internal features are auto/manual dialing from the keyboard, auto dial the next number if the first number is busy and instant redial once or until answered.

In the event of power disruption a battery back-up protects all memory in the PC212A. In addition, the PC212A is compatible with all of the communication programs written for the Hayes

Smartmodem™** such as CROSSTALK™† Also available

for use with the PC212A is the Rixon PC COM I,™‡ a communications software program (Diskette) and instruction manual to enhance the capabilities of the PC212A and the IBM PC. PC COM I operates with or replaces the need for the IBM

Asynchronous Communications Support Program. The program is very user friendly and provides single key stroke control of auto log on to multiple database services (such as The SourceSM§), as well as log to printer, log to file transfer and flow control (automatic inband or manual control). PC COM I is only \$49.00 if purchased at the same time as the PC212A. The PC212A comes with a 2 year warranty. For more information contact your nearest computer store or Rixon direct at 800-368-2773 and ask for Jon Wilson at Ext. 472.

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‡ PC COM I is a trademark of Rixon Inc.

§ The Source is a servicemark of Souter Telecomputing Corp.

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See us at COMDEX
at Booth #848

ACCESSORIES

er surface with paper-feed slot, a separate paper storage shelf, and a post-print fan-fold shelf. The PC Station can be configured for either right- or left-handed orientation, and is available in light or dark oak, walnut, white, or putty-colored finishes.

(List Price: \$199)
Quality Connections
2191 S. Grand
Santa Ana, CA 92705
(714) 432-0121

CIRCLE 763 ON READER
SERVICE CARD

uPC-600 Micro Power Conditioner

A surge suppressor/line filtering device incorporating both parallel and series circuitry in its design. This combination of circuits absorbs high voltage pulses, dampens oscillations in the power supply line, and prevents power sags from affecting a user's system.

The unit's six-foot power cord can be plugged into any existing outlet. A lighted rocker switch/circuit breaker protects the line from sudden short circuit surges, and provides a means to power up the user's entire system via a single control.

(List Price: \$250)
Power Control Inc.
1222-7 Fewster Dr.
Mississauga, Ont. L4W 1A1
(416) 624-6479

CIRCLE 767 ON READER
SERVICE CARD

Trav-L-Cases

A line of component carrying cases constructed of heavy plywood covered in scuff-resistant vinyl. Case construction features also include metal edges and corners, key draw-bolt locks, and padded handle, as well as a minimum of one inch foam padding on all sides of the interiors.

The Trav-L-Cases have been designed in sizes that will fit most components,

while allowing handling by one person.

Computer Case Co.
5650 Indian Mound Ct.
Columbus, OH 43213
(800) 848-7548
(614) 868-9464

CIRCLE 766 ON READER
SERVICE CARD

Firegone

A computer-safe, disposable fire extinguisher. The Firegone extinguisher contains two types of Halon—DuPont 1301 and I.C.I.

1211—which leaves no residue after use, is non-toxic,

and non-irritating to skin or eyes.

The hand-held fire extinguisher can discharge its contents at fires up to eight feet away. Once used, the canister is disposable, eliminating the need to recharge it periodically.

(List Price: 1.4 lb. unit \$39.95; 2.3 lb. unit \$59.95)
United Safety Associates, Inc.

P.O. Box 26954
Ft. Lauderdale, FL 33320
(305) 726-1884

CIRCLE 764 ON READER
SERVICE CARD

Comrex Diskettes

A line of 5¼-inch diskettes configured with a soft-sectored format, 48-tracks-per-inch maximum density, with 40 tracks per recording surface. The diskettes are packed in boxes of ten, and are available in the following four models:

- CR-10005- for single-sided, single density use;
- CR-10010- single-sided, double density;
- CR-10015- double-sided, double density; and
- CR-10020- a special premium double-sided, double density diskette with a lifetime guarantee (the first models carry a five-year guarantee from the manufacturer).

All diskettes are certified to be 100% error-free. They are tested for signal amplitude, resolution, low-pass modulation, overwrite, missing pulse error, and ex-



Comrex Diskettes, Comrex International

ACCESSORIES

tra-pulse error. They meet or exceed standards set by IBM, Shugart, ANSI, ECMA, ISO, and JIS.
(List Price: Per ten-pack: CR-10005 \$29.95; CR-10010 \$44.95; CR-10015 \$49.95; CR-10020 \$59.95)

Comrex International Inc.
3701 Skypark Dr.
Torrance, CA 90505
(213) 373-0280
Telex: 66 4859

CIRCLE 762 ON READER
SERVICE CARD

Blueprint Series

A series of poster-sized wall charts for dBASE II, WordStar/MailMerge, Lotus 1-2-3, and the PC DOS and CP/M operating systems. Each chart outlines the various commands of the software,

with explanations of what each command does.

Sets of charts run from two to six per application, depending upon the software outlined (WordStar runs to six charts, PC DOS is covered in two). Used near equipment, the charts aid the user in finding needed commands quickly.
(List Price: \$12.50 each set)
Onset Services
318 South B St.
San Mateo, CA 94402
(415) 573-1919

CIRCLE 761 ON READER
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Acoustic Enclosures

A line of full-size acoustical enclosures for dot matrix, daisy wheel, and other noise-generating printers. Enclosures are available in oak, walnut, and putty-colored finishes, and can be purchased fully assembled or in kit form.

Also available are enclosures for small-size personal printers.
(List Price: \$199-\$850, depending upon model)
Eagle Data Products, Inc.
P.O. Box 247
Northville, MI 48167
(800) 874-5368
(313) 634-0990

CIRCLE 745 ON READER
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Acoustic Enclosures, Eagle Data Products

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order entry	329
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time keeping and billing	679

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job costing	799

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accounts receivable	399
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inventory	479

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accounts receivable	575
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order entry/inventory	575
sales analysis	289

OPEN SYSTEMS

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inventory	559
sales order processing	559
purchase order processing	559
job costing	559

HERITAGE (JEWEL)

general ledger (client writeup)	\$579
accounts payable	419
accounts receivable	339
payroll	419
order entry	339
inventory	339
job costing	579
manufacturing (bill of materials)	339

TCS

	VER II	VER III
general ledger	\$429	579
accounts payable	429	579
accounts receivable	429	579
payroll	429	579
total sales		579
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client write up		929

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User-to-User

PC readers use this forum to help one another by passing along their questions, solutions, comments, and complaints.



Diskcopy Disaster

IBM's Personal Editor (PE) gets high marks as a text and program editor. Unfortunately, "Appendix E: Making Backups and Copying DOS" is misleading and erroneous. IBM tells you to use your own blank DOS formatted diskette to DISKCOPY PE. Thus, the user is lead to believe that PE has been copied onto his or her formatted diskette. Not so!

Everybody (except, apparently, IBM) knows that DISKCOPY automatically formats your diskette into the format of the original diskette regardless of any previous formatting on your diskette. This means that you always end up with an eight-sector, single-sided copy of PE (PE's own format) even though your DOS uses, say, nine-sector, double-sided formatting. Worse yet is the fact that any files

you had on your diskette are irretrievably erased.

A better method is to just COPY the three PE files (PE.EXE, PE.PRO, and PE.HLP or simply PE.*) onto your formatted diskette from the PE diskette. Other files already on your diskette will not be affected (unless, of course, one happens to have the same name as a PE file). Disregard the SETUP.BAT file completely. It just wants to do what is already done.

Bill Kraengel, Jr.
Valley Stream, NY

*It's always better to use COPY *.* rather than DISKCOPY, when making backup copies (unless some bizarre protection scheme is being used in the original) for the reasons you mentioned. Most software manufacturers release their products so that they'll work on any IBM PC system. And, unfortunately, the lowest common denominator is the 8-track, single-sided format, which holds a meagre 160K. Formatting a disk to your own system's specs and then copying all the programs from the original using COPY *.* is the only way to go.*

Double Dilemma

Users of EasyWriter II and ProKey may have noticed that EasyWriter's double underline font is preempted by ProKey's use of the same key combination,

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<alt>. Attempting to reassign <alt> confuses ProKey by making it think that you are defining another key. There is a way around this dilemma, though, and it involves using what is termed "extended ASCII."

The extended ASCII character set, of which <alt> is a member, is used to define special keyboard codes. A table of these codes can be seen in the *Technical Reference manual* on pages 2-14 and in the BASIC manual, Appendix G, page 7. When a program makes a request for a keyboard character from the Basic Input/Output System (BIOS) and the key struck is one that produces an extended ASCII code, BIOS first returns ASCII character zero. A second call is then needed to return one of the special codes. The way then to get an <alt> to EasyWriter without ProKey hearing about it is to use the extended ASCII code nested within a ProKey key definition.

For my example I decided to reassign the double underline font to <alt> since <altu> and <altd> were already taken for other fonts. The procedure is as follows:

1. Install ProKey, either with the /i option or while reading in your normal key definitions with the /r option.
2. Create the new key definition: First, press <alt>, then press <alt>. Now while holding down the Alt key, type the number 131 on the numeric keypad. (This enters ASCII character 131, which is the extended code for <alt>, into the key definition.) Then end the definition by pressing <alt>.

3. Write the new definition to file using the /w option on the ProKey command. It would be a good idea to use the DOS TYPE command and compare your file to the one in the listing—they should be identical.

Now the double underline function can be invoked with <alt>. Figure 1 shows what you should see on your screen.

Norris Boyd
Kingsport, TN

Further proof of ProKey's versatility and power. Users who like to program may want to experiment with the extended ASCII codes listed in Appendix G of the BASIC manual—they effectively double or triple the size of your keyboard, and they're rarely put to good use.

Calendar Magic

An algorithm for the day of the week of the first day of the year given:

- 1) January 1, 1801 is a Thursday, the fifth day of the week.
 - 2) Day = Sunday Day 6 = Friday, Day 0 = Saturday.
 - 3) A leap year is any year divisible by 4 unless it is a leap century.
 - 4) A century year is a leap year if the century is divisible by four. For this program, the century is INT (Year/100).
 - 5) The first day of any year is a day later than a previous year, except after a leap year, when it is two days later.
- With this in mind, if there were no leap years, we could write,

$$\text{Day1} = [5 + (\text{Year} - 1801)] \text{ MOD } 7$$

```
A>prokey /i
ProKey Version 02.13 (C) Copyright RoseSoft 1983 Serial # 00008842

Installing ProKey
A>e\
  prokey keydef.pro /w
ProKey Version 02.13 (C) Copyright RoseSoft 1983 Serial # 00008842

A>type keydef.pro
<alt>=<alt><alt>=<alt>
*
A>
```

Figure 1: Solution to Easywriter II/ProKey <alt> problem.

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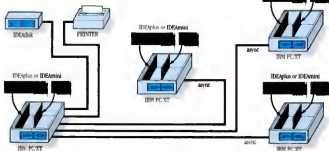


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```

100 'Calendar Starter -- Harry Gross (adapted by PC Magazine)
110 '
120 CLS:DEFINT A-Z
130 FOR N=0 TO 6
140 READ DAY$(N)
150 NEXT N
160 INPUT "Enter a year > 1800, (or 0 to end): ",YR$
170 YR=VAL(YR$)
180 IF YR=0 THEN END
190 IF YR<1801 THEN BEEP:GOTO 270
200 Y=YR-1801
210 C=INT((YR-1)/100)
220 CN=INT(YR/100)
230 D=(5+Y+INT(Y/4)-(C-18)*INT((C-16)/4))/MOD 7
240 LY=-(YR MOD 4=0 AND (CN MOD 4=0 OR CN<>(YR/100)))
250 PRINT "The first day of";YR;" is a ";DAY$(D);" day";
260 IF LY THEN PRINT CHR$(32);"(and it's a leap year)" ELSE PRINT
270 PRINT
280 GOTO 160
290 DATA Satur,Sun,Mon,Tues,Wednes,Thurs,Fri
    
```

Figure 2: This program finds the day of the week of the first day of a given year.

To simplify things, let

YR=Year, Y=YR-1801,
C=INT[(YR-1)/100], D=Day1,
CN=INT (YR/100)
Then D = [5 + Y] MOD 7

For every year after a leap year, another day must be added on,

$D = [5 + Y + \text{INT}(Y/4)] \text{ MOD } 7$

And a day must be subtracted for non-leap centuries after 1801,

$D = [5 + Y + \text{INT}(Y/4) - (C-18)] \text{ MOD } 7$

Only to be added back in every 400 years after 1601.

$D = [5 + Y + \text{INT}(Y/4) - (C-18) + \text{INT}((C-16)/4)] \text{ MOD } 7$

Another useful routine is to test for a leap year, LY=1.

$LY=-(YR \text{ MOD } 4 = 0 \text{ AND } (C1 \text{ MOD } 4 = 0 \text{ OR } C1 <> (YR/100)))$

The above were the basis of a calendar and a diary program (see Figure 2).

One can extend the above to earlier years, provided one can get the day of the

week for the first year of that century. This is useful only after 1582, the start of the Gregorian calendar reform.

Harry Gross
Ottawa, Canada

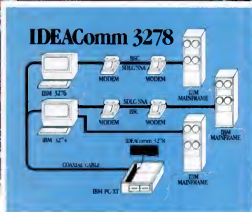
Any other nifty calendar/time/diary programs out there? Has anyone figured out a way to tap into the day-of-the-week version the PC uses when you first boot it up?

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Furthermore, all programs that create .COM or .BSAVE'd executable code from decimal or hex data must be accompanied by the source code in assembly language. This, too, will reduce errors and will be instructive to readers of User-to-User. ■

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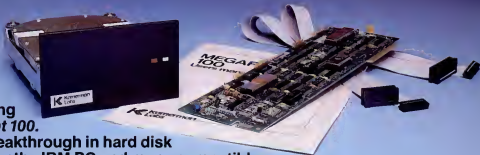
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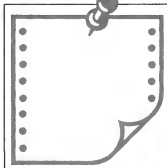
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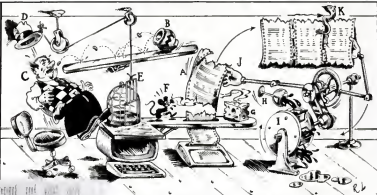
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RISING SPREADSHEET (A) KNOCKS MEXICAN JUMPING BEANS (B) INTO MOUTH OF NEUROTIC MAN (C) WHO IS SO DISCOMBOLATED THAT HE WALKS STANDS ON END, DISLAPPING HAT (D) WHICH OPENS CAGE (E) AND RELEASES EPICUREAN MOUSE (F).

MOUSE, INSPIRED BY SCENT OF PERFECTLY ASIED CAMEMBERT CHEESE, GNAWS THROUGH SPREADSHEET ONLY TO DISCOVER HE HAD BEEN FOOLED BY ALGEBRA OF OVER-LIFE GORGONZOLA (G).

IN A FIT OF PIGUE HE SPILLS VINTAGE WINE (H) INTO WRITER-WHEEL (I) WHICH TURNS POLLEY THAT CAUBED GLOVE (J) TO GRASP SPREADSHEET AND MOVE IT TO TAPING AREA.

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CIRCLE 173 ON READER SERVICE CARD

PC MAGAZINE • APRIL 3, 1984

MARK ZACHMANN

PC Tutor



Speedy String Packing

Q: I read an IBM user update, from February 1983, that included a machine-code routine for faster screen printing. The technique involved "string packing" the code into a string variable. You call this routine and its associated parameters with a single-precision numeric variable descriptor.

Unfortunately, this routine will not work for me, because the BASIC compiler I use requires a Call Absolute and an integer numeric variable descriptor.

Is there an approach, such as the one you suggested before to blank the screen (see "Screen Clearing," PC, Volume 1 Number 10) that's applicable here?

Peter Krouwer
St. Louis, Missouri

A: The routine you sent provides nothing more than a simple "move memory" command.

mand. It takes a string you want to print and moves it into the display memory.

Rather than tell you how to convert the first program so it would work with your compiler, I'll show you another routine that will accomplish the same task (see Figure 1). Since you'll be using a compiler, the speed should be adequate.

Change of COMMAND

Judging from my mail, there's a lot of you who use RAM disk programs. Tom Puckett suggested a routine, which uses some of the new functions in PC-DOS 2.0, that lets you reload COMMAND.COM from a RAM disk.

The file with COMMAND.COM needs to be reloaded into memory by PC-DOS whenever a program takes up so much space in memory while it runs that it overlays the portion of COMMAND.COM that existed at the top of the available RAM. To reload the file, PC-DOS tries to make a disk access to the A: drive. This is bothersome—especially if you don't happen to have a disk in that drive with COMMAND.COM.

If your system runs a RAM disk program, there's a way you can have COMMAND.COM loaded from a RAM disk when it's needed. If your RAM disk is called drive C:, just enter these two lines:

```
C>COPY A:COMMAND.COM C:
C>COMMAND C:
```

Once you do this, the operating system will turn to drive C: whenever COM-

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PC TUTOR

MAND.COM needs to be reloaded. Make sure that COMMAND.COM is actually copied onto the RAM disk. Otherwise, the operating system will prompt you over and over to insert the appropriate disk into drive C:—a physical impossibility that you can only resolve by rebooting the system.

If you want to switch back to the default, so the system looks for COMMAND.COM on drive A: rather than the RAM disk, simply enter the word EXIT.

When you use this technique, keep two points in mind about the new version of COMMAND. First, making the COMMAND call will take up about 3K more memory than before. Second, the new version of COMMAND will throw away any path settings you made previously; at the point you type in EXIT, the old path will take effect again.

The DOS 2.0 manual says you can get the same effect by entering this line:

```
SET COMSPEC=C:\COMMAND.COM
```

That method, however, did not work with my copy of PC-DOS 2.0

A Tandy Transfer

Q: I own a TRS-80 Model III and have a tremendous amount of software, written in Microsoft BASIC, in Tandy's 5¼-inch

format. While I wait for my IBM PC to be delivered, I'd like to find a way to avoid transferring all my files in ASCII form via a modem or direct-cable connection. Since the Tandy and IBM drives both use 48-track-per-inch disks, it seems there should be an easier way.

Since both machines use similar drives, can I assume that the disk-read head on each goes to the same physical location?

I'd also like to know if I can use a program like Disklook (from *The Norton Utilities*) to read my diskettes?

R. Cirotto
Burlington, Ontario

A: Since the two drives and recording formats are the same, you can, theoretically, read a Tandy disk on the IBM PC. Assuming that both drives are well aligned, you should be able to use Debug to read the Tandy disks.

Although this gives you a way to read the Tandy disks on the IBM, this method doesn't do the job of transferring the files. There's more that needs to be done to translate the disks. One problem is that the sectors are usually stored in a different order on the Tandy that would maximize transfer speed, since the TRS-80 is so much slower than the PC.

While I could write many pages of details involved in translating disks of one

```
10 REM This assumes a numeric string
20 REM Each integer is:
30 REM (256*attribute) + ASC(char)
40 REM A zero signals the end.
50 DEF SEG = &hB000 : REM The color data area
60 REM For monochrome use B000 instead
70 I = 0 : J = COLUMN + 160*ROW
80 REM For 40-width use 80 instead of 160
90 WHILE (0 <> DATA[I])
100 REM First, place the attribute
110 POKE(J+1, INT((1+DATA[I])/256))
120 REM Then, place the character
130 POKE(J, DATA[I])
140 I = I+2 : J = J+2
150 WEND
160 END
```

Figure 1: A BASIC routine for faster screen printing with the BASIC compiler.

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PC TUTOR

variety into another format, I'd conclude by recommending that the simplest approach is still to transfer the information over serial lines. If you can transfer at 4800 baud—a rate that's well within the capacity of the TRS-80 Model III—you could transfer a full diskette in about 5.5 minutes. That's not much of a wait. Even if you have to transfer 40 diskettes full of BASIC code, you could finish the job in about 4 hours, without having to give the process much attention.

To do this, all you need is to run compatible file transfer programs on the computers at either end. Most of these programs will let you transfer binary information, not just ASCII characters.

Keep in mind, however, that BASIC programs are usually stored in a compressed format, so the PC will be unable to make sense out of the code in the Tandem's compressed format. Because of this, you'll probably need to transfer these programs as ASCII-character files anyway.

Diagnostic Disk Magic

Q: After owning my IBM PC for about 3 weeks, I experienced an unusual problem. Occasionally my system has uncontrolled read errors on drive B: The PC-DOS error messages cite tracks 35 and beyond, in particular, as the culprits. I have discovered, however, that if I run the PC-DOS diagnostic routines before reattempting the procedure that led to an error message, the problem seems to have cleared up.

Can you explain what is going on? Do the diagnostic routines perform some sort of drive-speed or alignment adjustment that wasn't mentioned in the manuals? Can I use the diagnostics to correct something that's wrong with the operating system or the disk controller board?

Roland M. Brown, III
Baltimore, Maryland

A: I can think of a couple of possible reasons for your PC's errors, but none of them would involve the operating system.

The most likely cause is that there's too much friction against the B: drive's guide rails. It would be best to have your dealer fix the drives. If you can't arrange this, try the following:

Obtain some teflon lubricant. The kind that comes in small tubes, often available at automobile stores, is preferable to the kind in spray cans. In any case, never use oil, grease, or a graphite lubricant on the disk drives.

Remove the B: drive and carefully apply lubricant to the stainless steel rail (or rails) at the bottom of the drive. If you're using the spray teflon lubricant, put the lubricant on a foam (not cotton) swab rather than spraying it directly onto the drive.

Another possibility is that your drive head is dirty. If you suspect this is the cause, follow the instructions for one of the commercial head cleaners. This shouldn't be a problem after only 3 weeks, unless a heavy smoker is using the computer.

Such a new system is far more likely to have a speed or track alignment problem. If the drive was adjusted sloppily, the only remedy is to return the unit to your dealer.

The problem also might be caused by your disks. Marginal disks seem to fail most often on the outer tracks. The batch you've used so far could be of barely adequate quality. If this is the case, the main benefit when you run the diagnostics disk would be from it removing tiny impurities left behind by the inferior diskettes. Try using some top-quality diskettes and see if they help.

Most of these possible causes of your problem involve the hardware. At this stage of computer ownership, your dealer should help you take care of it. ■

The PC Tutor solves practical problems and explains points of general interest. If you'd like to see your questions answered here, drop a line to PC Tutor, PC Magazine, One Park Avenue, New York, NY 10016



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Handling Strings with MUMPS

Managing massive databases can be a breeze with the file-handling capabilities of Micro-MUMPS an implementation of a language developed for use in health-care settings.

Private physicians, hospitals, and outpatient clinics need to maintain on-line databases for hundreds and thousands of patients. Each patient's record might contain numerous dates of visits, problem and diagnosis lists, dozens of X-ray and lab test results, a detailed drug history, demographics, and billing information. Attempting to manage such a database with the ponderous file-handling capabilities of BASIC or COBOL could turn even the most enduring programmer into a basket case.

MUMPS is a better tool for such applications. This language was designed at Massachusetts General Hospital to provide speed and efficiency in handling related data files with an intricate structure. MUMPS is now widely used in the health industry and has been applied in other fields, such as library science and manufacturing, that have more of a demand for specialized handling of alphanumeric data than for scientific number crunching. (See "MUMPS: A Cure for Swollen Programs," *PC Magazine*, Volume 3 Number 5, for an introduction to MUMPS.)

Micro-MUMPS, a language interpreter for the IBM PC, provides functions that permit specific substrings in a data string to be rapidly isolated. Figure 1 shows how a few of MUMPS' string functions can work with a string variable that I've



named STR. In a program, the MUMPS string functions—such as \$EXTRACT, \$FIND, and \$LENGTH—can be written in full or abbreviated as SE, SF, and SL.

Commands that use MUMPS string functions require one, two, or three arguments. The first argument identifies the complete string of data to be worked on (the STR string in all examples in Figure 1). The second and third arguments identify a particular character or group of characters within the complete string.

The first command in Figure 1 might be interpreted like this: "Extract the first character from string STR and copy it into variable C." Executing this command does not change the contents of STR in any way. The second command is an alternate form of the first. Since the variable

D1 has "1" as its value here, both commands have the same effect. The third command, which has three arguments, tells the MUMPS interpreter to extract from string STR a group of characters that begins at position D2 and ends at D3.

The \$FIND command (SF) is used like \$EXTRACT. The fourth example in Figure 1 can be read as "find the substring 'CD' in STR and set variable C to indicate the position of the substring." If "CD" didn't exist in the substring, variable C would be set to a null value. Note that the value stored in C is not "3", the position of the first character in the substring, but "5", the position immediately after the substring. In the fifth example, the third argument (with the value "2") causes the command to give C the value "AB"—the position of the character that follows the second occurrence of the substring "AB".

The \$LENGTH function (SL) is used in the last two examples in Figure 1. The sixth example should be familiar to BASIC programmers; this command (with only one argument) simply finds the length (in characters) of string STR. The last example shows a more unusual use of the \$L function, which counts the number of times the substring SUBS occurs in string STR and gives variable C a value that's one greater than the actual number of occurrences.

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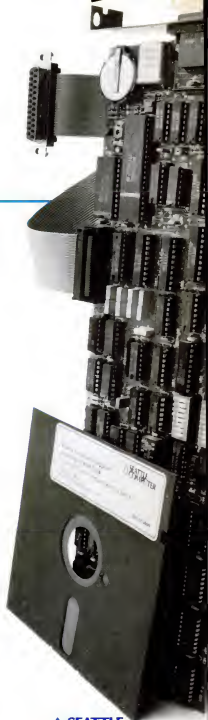
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LANGUAGES

Figure 2 shows MUMPS string functions working with a more useful string: a record, which I've called REC, that contains information about a patient named D. Baker. REC indicates that he is 32 years old, white, male, and single, and that he had visited the clinic on January 1, February 12, and July 21.

In the first example, the \$LENGTH command counts how many times the ";" character occurs in REC, and gives variable C a value one greater than the actual amount. In this case, the value in C tells the number of different types of fields in REC—a fact that's probably more useful than the actual number of semicolons.

The other three examples in Figure 2 use the \$PIECE function (\$P), which I feel is the most effective string-handling function ever built into a programming language. \$PIECE commands can be used to create, for example, a printed report from a file of records such as REC.

Commands using the \$PIECE function need an argument that identifies the full

data string to be worked on. The second argument identifies the delimiter (or separator symbol) that will be used to locate a substring within the complete string. The delimiter can be virtually any alphanumeric or punctuation character. The third and subsequent arguments identify the specific piece to be selected from the string.

The first \$P command in Figure 2 can be read, "Set C equal to the piece that precedes the first semicolon in REC." This command finds the patient's name. The next command has a fourth argument. It defines a substring that contains the second through fifth pieces of REC—all of the demographic data.

The \$P function can be nested in a command, as shown in the last example. The interior command,

```
$P(REC,";",6)
```

is executed first to find the sixth piece separated by a semicolon—in this case, the substring that lists the dates of visits to the clinic. Then the outer \$P command is performed on the substring to find the first item that is delimited by a hyphen. The result that goes into variable C is "1/1", the date of D. Baker's first visit to the clinic.

This last example shows how useful it is to have different delimiters within a record, and how important it is to plan the structure of a MUMPS file. If each date had been separated with a semicolon, like the other items in REC, I couldn't have used the nested \$P commands in such a straightforward way.

Very powerful and compact MUMPS commands can be written by combining different string functions. For example, this command will find the month when Mr. Baker has his first appointment:

```
C=$P($P(REC,";",6),"/",1)
```

The inner function—\$P(REC,";",6)—finds the sixth semicolon-separated piece of REC, which is "1/1-2/12-7/21". The outer \$P function extracts from this piece the first slash-separated piece—the number that tells the month.

A similar result could be achieved in BASIC by using the INSTR function to locate the position of the first occurrence of a hyphen in the REC string. Next, a MID\$ command could refer to this position and find the desired character. A BASIC advocate might look at the above example and maintain that writing the routine in BASIC would result in only a minor increase in the quantity of code, a point I'll readily concede. On the other hand, I challenge any programmer to produce BASIC code as concise as its MUMPS equivalent that will analyze the REC string to ascertain whether Mr. Baker had an appointment during the month of April. Here's my MUMPS code in its entirety:

```
S:$F(REC,"4/") A=1
```

Here, the variable A is set to "1" if the condition following the colon is true. If the string "4/" is found in REC, then at least one of the patient's appointments was in April, the fourth month.

Micro-MUMPS operates through PC-DOS to perform its file-collating duties. When you set up a MUMPS data file disk, a machine-language routine called SETGLOB first queries for the file size in order to establish sufficient map blocks. Then, through the interpreter, you can create any number of separate data files, all maintained automatically in ASCII-collation sequence. In reality, these files are all part of one PC-DOS file named GLOBALS.DAT. You can't move MUMPS files from one disk to another without moving an entire GLOBALS.DAT file, since you can't copy less than a complete file through PC-DOS. This causes problems when a group of related MUMPS files aren't on a single floppy disk.

Copies of Micro-MUMPS can be obtained by writing to Richard F. Walters, Division of Computer Sciences, University of California, Davis, CA 95616. A variety of publications on MUMPS are available from the MUMPS Users Group, 4321 Hartwick Rd., #308, College Park, MD 20740, (301) 779-6555.

VARIABLES:	
STR="ABCDEABCD"	
SUBS="CD"	
D11, D22, D33	
COMMANDS	RESULTS
CSE(STR, 1)	C="A"
CSE(STR, D1)	C="A"
CSE(STR, D2, D3)	C="BC"
CSE(STR, SUBS)	C5
CSF(STR, "AB", 2)	C8
CSL(STR)	C9
CSL(STR, SUBS)	C3

Figure 1: Examples of how some of MUMPS' string commands—\$EXTRACT, \$FIND, and \$LENGTH—act upon some sample variables.

REC="Baker,D,32,W,M,S;1/1-2/12-7/21"	
COMMAND	RESULT
CSL(REC,";")	C6
CSP(REC,";",1)	C="Baker,D,"
CSP(REC,";",2,5)	C="32,W,M,S"
CSPSP(REC,";",6),"/",1)	C="1/1"

Figure 2: Examples of how the \$LENGTH and \$PIECE functions act on the string REC, which contains a patient's record.

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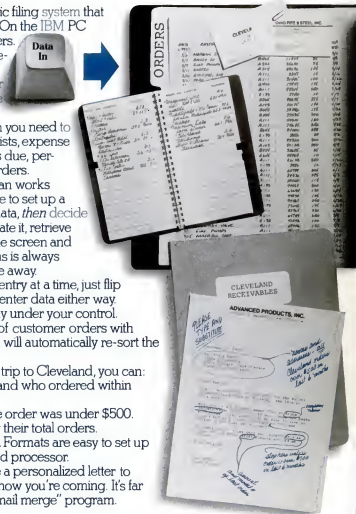
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214-345-7296	CLEVELAND, OH	04/19/83	581	75	A-183
212-333-6680	NEW YORK, NY	04/22/83	395	96	C-645
216-561-9428	CLEVELAND, OH	04/22/83	775	35	C-554
216-974-4278	CLEVELAND, OH	04/24/83	583	81	A-111
383-444-4480	PUEBLO, CO	04/24/83	756	45	A-111
32-48-654-81	TOKYO, JAP	04/26/83	848	88	C-645
316-985-6738	MICHITA, KS	04/30/83	56	76	C-133
817-667-3475	FT. WORTH, TX	05/04/83	953	88	A-111
716-589-5732	ROCHESTER, NY	05/09/83	981	23	A-183
513-982-7454	DAYTON, OH	05/14/83	356	75	C-554
289-858-7773	TURLOCK, CA	05/14/83	295	47	C-645
313-363-4951	DETROIT, MI	05/19/83	981	23	A-111
581-825-5469	FT. SMITH, AK	05/26/83	39	86	C-133

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PROJECTIONS	Link Module	216-974-4278	CLEVELAND, OH	04/24/83	583	81	A-111
INFORMATION	Link Module	383-444-4480	PUEBLO, CO	04/24/83	756	45	A-111
DEVELOPMENT	Link Module	32-48-654-81	TOKYO, JAP	04/26/83	848	88	C-645
TESTING	Link Module	316-985-6738	MICHITA, KS	04/30/83	56	76	C-133
TRAINING	Link Module	817-667-3475	FT. WORTH, TX	05/04/83	953	88	A-111
MARKETING	Link Module	716-589-5732	ROCHESTER, NY	05/09/83	981	23	A-183
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ADMINISTRATION	Link Module	313-363-4951	DETROIT, MI	05/19/83	981	23	A-111
LEGAL	Link Module	581-825-5469	FT. SMITH, AK	05/26/83	39	86	C-133

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Telex Changes With The Times

The predecessor of today's electronic mail systems has changed little in 30 years. Now telex is being retrofitted so that PC users can transmit messages around the globe.

On business cards, in ads, and on corporate stationery, right next to the telephone number, you'll occasionally see the word **TELEX** followed by a code of digits and an unpronounceable group of letters. This code unlocks the international telex system, the forerunner of modern-day electronic mail systems, that ties together every country in the world. Telex is a decades-old way of communicating printed information between two locations and probably still has more subscribers than do all of today's e-mail systems put together.

Telex is a method of communicating information between stations, originally between teletypewriters—commonly abbreviated TTY. TTY-to-TTY operations started in the United States in the early 1940s with a service called TWX (teletypewriter exchange, operated by AT&T). Several years and several lawsuits later, TWX merged with telex. Telex service as we know it today—station to station—began in the mid-fifties.

Telex was a second-generation electronic mail system. The familiar TTY, a clunky, cranky, often unreliable piece of equipment, was connected to a central exchange, which in turn connected to other exchanges and formed a network. As with AT&T before deregulation, the TTY user rented both the machine and a line connecting it to the central office. (For a



long time, in fact, the lines were leased from AT&T.) Today, as with the telephone company, users must still rent the line, even though the machine can be purchased.

Traditionally, the TTY caller dialed the telex number belonging to the intended recipient, and when that machine answered, the caller transmitted the message. The receiving TTY answered incoming calls by first transmitting its unique ANSWERBACK code identifying itself so the calling machine knew it had reached the correct number. Obviously, there are some limitations to this process: If the paper roll on the teletype ran out, jammed, or tore, the recipient might have no way of knowing that a message was sent. Therefore, if the receiving machine is inoperable, it sends back a signal that it

cannot receive messages. It transmits a busy signal if someone else is transmitting to it.

One problem with the standard method of dialing up another telex is that the caller must be online, that is, must be sitting at the sending terminal in real time. In 1965, therefore, Western Union Telegraph Company installed its InfoMaster computer. This permits it to store-and-forward messages. Almost all telex companies now use computers to store incoming messages and keep dialing the recipient until contact is established.

Other than this, telex hasn't changed that much, but now telex carriers are adapting and retrofitting the system to enable it to serve personal computer users.

Users can dial into the system to receive or send messages without needing to buy or rent a specialized terminal. With a PC, communications adapter, modem, terminal emulation software (such as *Crosstalk* or *PC-TALK*) and an account with a telex carrier, you can send messages anywhere in the world. (Carriers include Western Union, ITT World Communications, Consortium Communications International, and many others.) Because you can access the system from any phone in the United States with a local call or a WATS, or 800 number, you don't have to be stuck in your own office to send—and more importantly, to re-

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ceive—telex messages.

As currently constituted, most of the retrofitted telex systems lack the elaborate verification and time-stamping features of more sophisticated, purely computer-based data communications systems. Also, since the telex system is basically

As telex carriers have installed computers and dial-up access over standard telephone lines, their services have become significantly more flexible.

oriented toward hard copy, once you have received a message it's gone forever—you can't save or file it on the system. Since it can be difficult to read material going by on a screen even at 300 baud, the best bet is to always turn on your printer or disk storage before signing on.

How does it work? I am most familiar with ITT World Communications' Timetran service from my work as a correspondent for several overseas publications. To file my dispatches every week I use the following procedures: I start by calling my local number for the ITT Timetran computer, which is set up for 300 baud. When it answers, I enter my account number and answerback code. When ITT's Timetran computer has accepted and validated my account number and answerback code, it gives me permission to start transmitting.

Let's say I'm filing a story for a United Kingdom publication. I start by entering the country code for the UK, 851, followed by the six-digit telex number, a plus sign, a slash, and the answerback code of the machine I'm calling. At this point, I

transmit my copy in one of two ways: Either I key it in, or, if I've prepared it ahead of time in the proper format, I tell my software (*PC-TALK*) to transmit it from the disk. Transmitting from disk is similar to transmitting from the prepared paper tape available on most telex machines, except that it's far easier to set up text with a word processor than to play with paper tape which has an annoying tendency to jam or rip at the worst time.

In recent years, as telex carriers have installed computers and dial-up access over standard telephone lines, their services have become significantly more flexible. For example, Western Union Telegraph Company's EasyLink service can accept both upper and lower case characters, yet will transmit in all upper case to those receivers that do not accept mixed characters. To accommodate some of the older receiving terminals, it's a good idea to limit your lines to roughly 65 characters long. Each line must end with two characters—a carriage return (CR) and line feed (LF). (On the IBM PC, the line feed character, an ASCII 010, is generated by pressing the Ctrl-J key combination.)

Telex systems also require specialized codes. For example, ITT's Timetran service recognizes the character string NNNN as the end of a message, on the theory that this character string is unlikely to occur as the content of an authentic message. The end of a transmission is indicated by five periods. To retrieve my incoming messages, I type into my computer :SEND MESSAGES, followed by my private, seven-letter password. At that point, inbound messages are transmitted to me.

As with many electronic mail systems, telex can transmit the same message comparatively easily to separate recipients. With most systems you can prepare a standard distribution list ahead of time and then transmit the message to all the recipients by simply naming your list the TO-LIST. (Although you transmit to Timetran at 300 baud, your messages are subsequently transmitted via undersea cable at

only 50 baud.)

Most services do not require you to pay a minimum or monthly fee but publish a list of per-minute charges. Consider my call to the UK: ITT charges \$1.41 per transmission minute (about 50 characters), regardless of whether it receives a mes-

Even if you have no special computer expertise, it takes no more than 30 minutes to become familiar with most telex systems and the corresponding software.

sage via Timetran or via a conventional telex communications line. With Western Union's EasyLink service, users are also charged for the amount of time required to input their messages into EasyLink.

By contrast, during a 1-minute daytime phone call to the United Kingdom (at \$1.26 per minute from Boston), I can speak approximately 110 words, or 660 characters—which makes voice messages considerably less expensive than telex.

Many of the hotels that cater to business travelers and conventions have long had telex operators who send messages for a fee, and in the past 2 years, a few hotels have put terminals in guest rooms. More recently, AT&T has begun experimenting with putting in public locations telex terminals activated by credit cards with magnetic stripes.

Even if you have no special computer expertise, it takes no more than 30 minutes to become familiar with most telex systems and the corresponding software. It can be an inexpensive, comparatively painless way of accessing a full-blown international electronic-mail system. ■

Getting Satisfaction

If the micro, peripheral, or program you just bought turns out to be a lemon, you don't have to grin and bear it. These effective complaining techniques can get you the results you want.

This is the first of a two-part excerpt from Computer Buyer's Protection Guide: How to Protect Your Rights in the Microcomputer Marketplace by L.J. Kuten. The paperback is published by the Spectrum Book division of Prentice-Hall, Inc., Englewood Cliffs, NJ 07632.

Effective complaining gets results. Take a case that was reported in the *Manhattan Micro News*, a user group newsletter. A member of the group had a problem with his IBM PC motherboard. Twenty-two days after the 90-day warranty expired, it failed and a repair technician believed the cause was a single, soldered-in RAM chip. IBM's suggestion was to replace the entire motherboard for \$1,000. Its company policy did not allow technicians to remove the soldered-in chips. The owner did not get satisfaction until he told IBM and the seller that he would pursue the matter through the Massachusetts court system.

This owner did nothing special. He merely complained effectively. There is no secret to effective complaining. It is necessary only to follow certain tried and true steps.

Consumers have problems with hardware and software for four main reasons. The first reason is the fundamental difference between microcomputer hardware and software and other consumer goods—

their complexity. You cannot turn them on like a television set and expect them to work. Second, there is no uniformity in this industry. Once you know how to drive a car, you can drive any automobile. Change your computer and software, and you must start over at square one. Third, most documentation lacks detail and is poorly written. Fourth, many people refuse to read instruction manuals.

Communicating the Problem

A hardware or software problem is not a bona fide problem until it happens more than once or to more than one person. If it happens only once to one individual, it could be caused by items such as fluctuating electricity or operator error.

Whenever hardware problems arise, make a record of the symptoms so that you can repeatedly describe them in the same manner. Know under what particular circumstances they show up. Ascertain if the problem is continuous or intermittent. Be able to demonstrate your problem when taking the unit in for repair.

Software problems, especially random bugs, are the most difficult problems to solve. Theoretically, every program has undergone extensive testing before being released and has been thoroughly debugged. Therefore, your bug should not have occurred. Add to this the problem of operator error. Many times what seems to be a

bug is actually how the program works.

Saying that a problem exists is not sufficient. As with a hardware problem, being able to consistently generate the problem or giving the author or vendor a diskette to examine that clearly shows the bug is to win half the battle. When having hardware or software repaired, write a detailed letter explaining the problem. Make sure to include documentary evidence such as an unreadable diskette or illegible printouts when taking the unit in (make copies for your records). If you ship your goods to a repair center, make another copy and mail it separately.

Remember: Just because the vendor says a hardware or software package is compatible does not mean it actually is! A recurrent problem with microcomputers is that the hardware or software fails when a new peripheral or patch is added. Most times, even though the problem seems unrelated, the new peripheral or patch is the culprit. If the hardware or software was working fine until the new peripheral or patch was added, disconnect the new equipment or reverse the patch and see what happens.

Store in a file folder all sales slips, credit card vouchers, cancelled checks, repair tickets, and advertisements that deal with your microcomputer purchases. Good records are very important when there is a recurring problem that no one

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has been able to fix. Confronting a dealer or manufacturer with the previous repair tickets will negate the claim that there has not been a sufficient opportunity to effectuate a repair. The repair tickets will be the proof that the manufacturer's warranty has failed in its essential purpose.

Note the day the equipment was taken in and returned. Make sure your copy of the repair ticket is readable. Customers typically get the unreadable second or third carbon copy.

When you call about a problem, get the name (have it spelled) of the person you are speaking with. As soon as the conversation ends, write down the name, the date, the time of the call, and what was said by whom. This way you have a contemporaneous notation that can later be used to refresh your memory.

Repair Services

Always get a receipt when leaving equipment with anybody for any purpose. Otherwise, there may be no record of your leaving the equipment. Repair receipts typically state that the repair center is "Not Liable For Goods Left Over 30 Days" or "Not Liable For Loss of Equipment." These words have no legal effect. If the repair center loses your equipment, it is liable for its current value (usually less than replacement cost). Also, a repair service cannot sell your equipment if you do not immediately pick it up. Most states have statutes on this point that say the goods have to be held a certain length of time before they can be disposed of. Contact a local consumer group for your state's specific requirements.

Not all "factory authorized repair centers" will fix your computer under the warranty terms. Some repair only equipment that they sold. Also, find out how the warranty bill will be paid. Some repair centers require you to pay personally for the repair work; you then file a claim for reimbursement against the manufacturer or warrantor. A repair center can retain possession of your equipment until you (or the warrantor) pay for the work.

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Unless you have prior experience with a particular repair service, do not assume that the equipment has actually been fixed. Test it before paying for it or taking it home. If the equipment does not work perfectly when you pick it up, write that fact on the receipt you are asked to sign. Get the service technician to initial your comment. If he will not, write the fact that he refused on the ticket.

Working Within the System

Always give the seller the first chance to repair the equipment. He has a vested interest in keeping his customers happy and retaining their good will. Other authorized dealers, although they may repair the unit under the warranty terms, may not give as quick or good service to you as they would to their own customers. This unfortunate result arises because warranty repairs are typically reimbursed at a lower rate than would be charged if the customer paid the bill directly.

Before complaining, decide on the minimum you will accept. Do you want your money back? Do you want the unit replaced? Do you want it fixed? Decide before making your complaint and stick with that demand. It is a good tactic to ask for more than you think you can get. This way, if you do not get your original demand, you appear magnanimous when settling for less.

When settling any complaints, get the terms in writing. If the other party refuses to write you, then write him or her a letter stating what your understanding of the settlement is. If you fail to do this, nothing prevents the other party from claiming, "I never said that," or "You misunderstood what I meant." If you write a letter expressing your understanding of a settlement and the other party does not object to its contents, he looks bad when he later says you are wrong.

If you are instructed to bring or ship the unit back for repairs or replacement, do it now—not next week. Have you received a letter in response to a complaint?

(continued)

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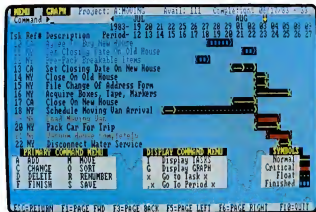
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Answer it immediately, and follow its instructions. If you are lackadaisical, the other party will be, too.

In dealing with a problem, find out who in the company can resolve it and start dealing with him or her. This person is generally a department, store, or service manager. If someone says he cannot resolve your complaint or he does not have the authority to do what you want, ask him for the name and address of the person who has the authority. Write a letter to that person and refer to your dealings with the first person. If the first person will not give you the name of his superior, write to the president of the company. The name and address of the president can usually be found by writing to the Secretary of State's Office, Corporation Division, in any state in which the company is licensed to do business. The state mentioned in the company's advertising literature is usually where its corporate headquarters are located. For a nominal fee, the Secretary of State of that state will send you a form with the information you need.

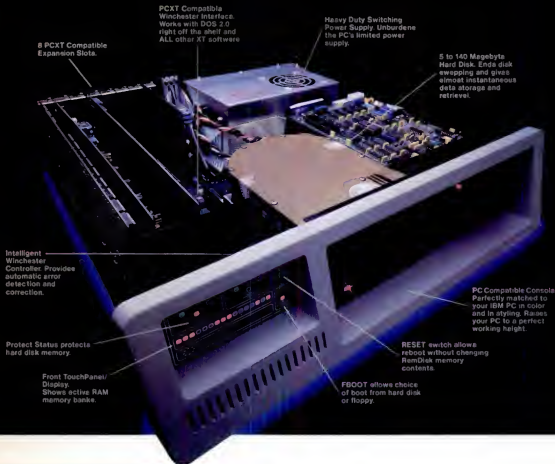
Do not be afraid to go to the top. One of the nicer aspects of dealing with a large corporation is that you can always work your way up the hierarchy of the corporate officers. The only person who can ultimately say "No" is the president.

The letter should be brief and to the point. If there are many problems, ignore the minor ones. Do not act apologetic, yet do not appear to be domineering.

This letter will go to the owner or the president. Usually, you will get a call or letter saying to bring the equipment in. If there is more than one service technician, the best one will be assigned to repair your equipment. He will now work his butt off trying to fix the equipment because he knows his boss is concerned with your happiness. He knows you will not hesitate to write a second letter saying you brought it in but that it was still not fixed. ■

L.J. Kutten is a St. Louis lawyer and computer hobbyist who specializes in computer and high-technology law.

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Inside The Source

In the next installment of *PCjr. Magazine's* Baedeker to communications networks, we travel—electronically and in person—to The Source.

Dear Parents

The reflections of a 12-year-old computer user on what kids really want, and what you should know as a parent.

Selling Junior

A report from an industry-wide conference of third-party manufacturers on their hopes and dreams for bringing up junior.

Columns

Corey Sandler on Great Moments in microcomputerdom; Don Kennedy discusses video game addiction; Lindsay Van Gelder reviews fill-in-the-blanks correspondence software; John Worum tells you how to save your BASIC programs on disk or cassette; Eric Freedman writes about privacy issues for computer network users; Peter Norton gives thanks for PCjr's memory; Steve Rosenthal explains the alphabet soup of RAM, ROM, PROM, EPROM, and all the rest; and Stephen Manes grouches for a few pages.

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COMING UP

FOR IBM PERSONAL COMPUTER USERS TECH JOURNAL

ANS COBOL Standards

How do the four major COBOL compilers comply to ANS standards? A feature-by-feature comparison of compilers from Microsoft, Micro Focus, Ryan-McFarland, and mbp to the ANS COBOL X3.23-1978 standard.

Trace86 and Codesmith-86

Members of the new generation of assembly language debugging tools, Trace86 and Codesmith-86 are two powerful, memory-mapped, program-tracing utilities.

High Resolution Timing on the PC

Standard timing information available to PC users is close to useless for events measured in electronic time scales. A look at some techniques for obtaining timing information with microsecond resolution.

LISP for the PC

A language implemented on large minis and mainframes to satisfy the research needs of the artificial intelligence community has come to the PC. An in-depth review of three LISP products: IQ LISP, TLC LISP, and mulLISP.

Sorting Methods and Timing for the PC

Alternatives to the easy-to-code but very slow bubble sort: Implementation and performance of eight sorting algorithms for the PC.

Routines for Controlling Sounds on the PC

An excerpt on sounds from the Waite Group's *Bluebook of Assembly Routines for the IBM PC*, with program listings for producing various sounds, including a routine to play music on the PC.

Tale of Two Mice

Product review: How do Microsoft's mechanical mouse and Mouse Systems' optical mouse fare in the electronic maze?



Flip the pages. You see PC modem cards with fewer features advertised for as much as \$599. Up until now that's how much it cost to make a modem capable of transmitting at 120 characters per second (1200 baud). It doesn't take a computer to figure out the savings in phone line charges when you communicate four times faster than the 30 character per second modems (300 baud). Now you can have the solution to your communication needs at an affordable price.

SEE HOW THEY WORK

You can imagine how precise the components have to be to convert tones over a phone line into 120 characters every second. Precision equates to cost. With the advent of the mass market in personal computers the economies of scale drove the costs of manufacture down, but did not effect the precision required. The technology used is called "analog filtering". It is the process of sending (modulating) and receiving (demodulating) tones with perfect pitch. A lot of adjusting, noise suppression, and a little magic is required. Real expensive. Some use lots of chips and filters (known as discrete components). The latest rage is LSI (Large Scale Integration) technology. Which is the same old analog stuff condensed onto fewer chips.

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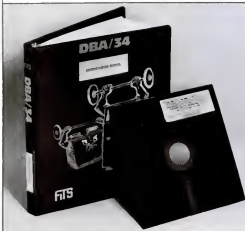
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Video Monitor Review

Many manufacturers claim that their monitors act as both TV screens and computer monitors. Bill Machrone will test some of these monitors and report on which ones stack up best.

Dapper, Engineers, and the PC

PC will profile Gene Knight, president and principal engineer of SKM Systems Analysis, Inc., who has developed a program called *Dapper* that solves the mathematical problems associated with electrical engineering. The program is probably the first significant engineering application created for the *PC*.

Energraphics

We'll review *Energraphics*, one of the first packages to permit two- and three-dimensional imaging, as well as computer-aided design on the *PC*.

PC Goes to College

Micros are going back to school to learn why scholars in all disciplines employ PCs to help with research, run classes, and print and publish their findings.



Writers, PCs, and Typewriters

A style writer for the *Washington Post* will discuss how the microcomputer is changing the nature of creative writing. He'll explore how writers have been affected by a switch from reams to bytes. Do editors see a difference in the writing produced by such a switch? How might a writer profit from understanding the process?

StarPac

PC takes its first peek at *StarPac*, the system that integrates all the Star software packages from MicroPro, including *WordStar* and *DataStar*.

PCs in Pinstripes

IBM's dream is to have a PC on every desk in America. Some of the country's largest companies are taking the plunge. What kinds of special problems and benefits are these corporate giants facing? Paul Somerson tells you all about it.

PCs Preparing Tax Returns

David McManigal is ecstatic over how easy—and fast—preparing his tax return became with the help of *VisiCalc* and the template he created. Although no two tax returns are alike, McManigal will show you how to custom design your template using your own spreadsheet program.

Managerial PCs

The introduction of PCs into corporations is having a profound impact on middle management in American companies. This report explores how microcomputers have transformed the way managers go about their business.

Columns

In addition, *PC* will feature its usual guest columns containing information and opinions by professionals in a variety of fields. Topics to be covered will include: How to complain—and get results—when your PC doesn't work correctly; how the American Bar Association is using PCs as a professional tool; tax advantages of buying a micro; and a look at *Spell-It*, a word processing package.

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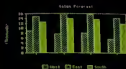
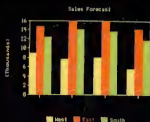
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